

**BIOGRAPHICAL MEMOIRS OF FELLOWS
OF THE
INDIAN NATIONAL SCIENCE ACADEMY**

Volume 6



**INDIAN NATIONAL SCIENCE ACADEMY
NEW DELHI**

The present volume, the sixth in the series, contains memoirs on eleven deceased Indian scientists in various disciplines who were Fellows of the Indian National Science Academy (*formerly, the National Institute of Sciences of India*).

The memoirs are contributed by scientists, in most cases close professional associates, who were intimately connected with the life and scientific career of the scientist.

With the intelligent layman rather than the specialist in mind, the authors give a simple description of the scientists' contributions to new knowledge. To help specialists, an exhaustive bibliography of the scientist's works is given with the memoir.

(Please turn to back flap for names of scientists covered in two previous volumes)

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OF THE
INDIAN NATIONAL SCIENCE ACADEMY

Volume 6

BIOGRAPHICAL MEMOIRS OF FELLOWS OF THE INDIAN NATIONAL SCIENCE ACADEMY

(formerly, National Institute of Sciences of India)

1979

VOLUME 6



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PREFACE

THE present volume portrays the biographies of eleven eminent men who made rich contributions to diverse areas of science such as geology, forestry, physics, mathematics, medicine and oceanography.

Dr. J. A. Dunn was a contemporary of Sir Lewis Leigh Fermor. These men together put India on the Geological Map of the World. Dr. Dunn was a pioneer in the techniques of the study of opaque minerals under reflected light and also in the field of microscopic characters of ore minerals of India. He is remembered for promoting the utilization of copper ore deposits in India.

Drs. S. N. Kapur, K. D. Bagchee, D. Narayanamurti and N. L. Bor were internationally known for their work in the various spheres of forestry science. Dr. Kapur had an expert knowledge of properties of Indian woods and developed new techniques of seasoning. Bor, an officer of the Indian Forest Service, was an outstanding botanist and an authority on Asiatic grasses. To Dr. Bagchee goes the credit of studying the diseases of important Indian timbers and developing the Forest Mycology Herbarium at the Forest Research Institute, Dehra Dun. Dr. Narayanamurti studied the chemistry of Indian woods and developed several types of indigenous adhesives for plywoods and hardboards for defence, aircraft and railways.

A special feature of the volume is a Memoir on Rao Bahadur Venkatesachar who lived to a ripe age of 93 and who combined in one personality an astute experimental spectroscopist, a great proponent of the Dwaita philosophy of Madhvacharya and an authority on Hindu religion.

The two contemporary mathematical giants included in this volume are Professor R. N. Sen, known for his work on 'Differential Geometry of Riemannian and Finsler spaces' and Professor B. Sen, whose forte was 'Mathematical Elasticity'.

An outstanding pathologist and teacher of Bengal, Dr. M. N. De made extensive clinical studies on tropical diseases, especially epidemic dropsy, Bengal splenomegaly and influenza. Through his example, he stressed the need for sustained research to maintain progress in medical knowledge.

It is more than mere coincidence that this volume contains the prismatic portraits of Dr. A. N. Lahiri and Dr. N. K. Panikkar, two of our very brilliant scientists, who could pack into their lives high achievements. Through sustained work, they enriched the survey, management and utilization of the natural resources of India.

The life sketch of Dr. Lahiri, a brilliant geochemist, focuses our attention to his monumental contributions to Coal Science and Technology in the post-independent India. It is mainly through the intensive studies directed by him that our coal production particularly, of the high grade, could be stepped up. Dr. Lahiri's life was symbolised by coal—the subject of his study—intense and radiant.

Dr. Panikkar's scientific interests were wide. His sound training in the physiological adaptations of marine animals attracted him to the pursuit of larger issues like the organization of research and training in fisheries in India. Later his interests in marine sciences broadened and he took up the Directorship of the Indian Programme of the International Indian Ocean Expedition. He was also the Founder Director of the National Institute of Oceanography which acquired the first ocean-going research ship R. V. GAVESHANI.

We feel assured that, standing on the shoulders of these stalwarts, we, of the present generation, may be able to see a little bit farther in the horizon of knowledge.

On behalf of the Academy and on my own, I have much pleasure in extending our grateful thanks to Professor B. R. Seshachar F. N. A., former President of the Academy, for his generous help in scrutinizing the manuscripts. I also acknowledge the services rendered by Professors H. Y. Mohan Ram and S. K. Trehan, Editors of Publications, and by members of the Editorial staff of the Academy in producing this volume.

Dated : May 20, 1979

V. RAMALINGASWAMI
President

CONTENTS

		PAGE
<i>Preface</i>		<i>i</i>
John Alexander Dunn	<i>By S. Deb</i>	1
Shankar Nath Kapur	<i>A. C. Sekhar</i>	6
Norman Loftus Bor	<i>M. B. Raizada</i>	10
Krishna Das Bagchee	<i>M. B. Raizada</i>	20
Rao Bahadur Bachalli Venkatesachar	<i>B. S. Madhavarao</i>	24
Manindra Nath De	<i>S. C. Seal</i>	31
Rabindra Nath Sen	<i>M. C. Chaki</i>	37
Duraiswami Narayanamurti	<i>M. B. Raizada</i>	42
Adinath Lahiri	<i>Satyaprasad Raychaudhuri</i>	57
Bibhutibhusan Sen	<i>A. K. Mitra</i>	77
Nedumangattu Kesava Panikkar	<i>S. Z. Qasim</i>	82

A photograph and an autograph of the subject are printed with each memoir.



John

JOHN ALEXANDER DUNN

(1899–1966)

Elected F.N.I. 1935

EARLY LIFE AND EDUCATION

JOHN ALEXANDER DUNN was born in Liverpool, England, on 27th June, 1899. Within a year or so, his parents migrated to Victoria, Australia, where he had his early schooling. In his school days, Dunn used to collect beautiful rocks and mineral samples, and he had a great fascination for geography. Later on, he selected mining engineering and geology as his career and obtained the Diploma in Mining Engineering from the Melbourne Technical College. He was awarded a Scholarship in Mining and was elected to the *Australian Metal Exchange Bursary Scholarship* in Mining during 1918–19. Subsequently, he graduated with first class honours in geology from the Melbourne University and was honoured with the '*Howitt Natural History Scholarship*' in 1920. He went to London for further studies and was admitted to the Royal School of Mines of the Imperial College of Science and Technology, London. Due to his keen interest in various branches of Earth Sciences, during his research activities in London, he was awarded the '*Frecheville Research Fellowship*' of the London University in 1921 and in the same year, he obtained his Diploma of the Imperial College (D.I.C.). In the same year, Dunn went back to Australia and got a job in the Bendigo Amalgamated Goldfields Ltd., as a Mine Surveyor. Dunn's enthusiasm and interest in research made him utilise his spare time and leisure hours for the study of rock-types and petrological aspects of the ore-minerals associated with the gold-bearing formations. In the earlier part of 1921, he carried out a geological investigation of the tin and osmiridium mines in Tasmania. In the same year, he again went to England in order to obtain first hand knowledge of the famous tin deposits of Cornwall. His studies were mainly based on the petrological aspects of the host rocks for the concentration of tin-bearing minerals and he always tried to understand the economic possibilities of the complex polymetallic ore-bodies. During the later period of 1921, Dunn was selected for the post of Assistant Superintendent of the Geological Survey of India and at the initial stage he was placed in the coal-field survey party under Sir Cyril S. Fox. Thereafter, he was sent to the Singhbhum area of Bihar, where he worked for a number of years and produced two voluminous memoirs on the geology and mineral resources of the Singhbhum district. The most significant contributions of Dunn in Singhbhum are the detailed study of the copper deposits of Mosaboni, Rakha Mines, Tamapahar and Bedia-Surda areas and also the Uranium-bearing rocks of Judugara and the adjacent regions which are considered to be the most important Uranium producing areas of India. His contributions to the petrology,

stratigraphy and mineralogy of Singhbhum thrust-belt are very praiseworthy. The copper mineralisation of the shear zone in Singhbhum was ascribed to sodagranites of the area which was one of the hypotheses of Dunn, although more recent workers in the field do not fully subscribe to Dunn's theories.

In 1924, Dunn submitted a thesis in Melbourne University on the geology of Northern Singhbhum, including parts of Ranchi and Manbhum districts. The degree of Doctor of Sciences was awarded to him in 1926 for this monumental work. Dunn also studied the kyanite, sillimanite and corundum deposits of Assam and produced another important memoir.

SERVICES IN INDIA

Dunn acted as Curator of the geological collections in the Indian Museum during 1929–31 and at that time, he worked as part-time Professor of Geology at the Presidency College, Calcutta. He acted as Superintending Geologist in the same year. His reputation as an eminent worker in the field of Indian Geology was well recognised both in India and abroad. During the devastating earthquake of North Bihar and Southern Nepal on 15th January 1934, Dunn was deputed to investigate the origin of the severe quake shock, which killed many lives in Monghyr, Bhagalpur, Purnia and the adjoining areas of North Bihar.

In 1934–35, Dunn took several hundred specimens of Indian ore-minerals, particularly copper and manganese to Berlin and Freiberg in West Germany and mastered the complex technique of ore-microscopy in the laboratories of Paul Ramdhor in Berlin and Hans Schneiderhöhn in Freiberg. Later on, he went to Paris and studied samples of Indian manganese ores in the mineralogical laboratory of Professor Jean Orcel, in the Museum of Natural History, Paris. Professor Orcel was engaged at that time in the study of the manganese minerals by means of the photo-electric method of selenium cells.

VISITS TO U.S.A. AND CANADA

Dunn visited the United States of America and Canada during 1937–38. He went to Yale, Princeton and Harvard and stayed there for a few months to study the Indian minerals by some new methods of investigation. He also visited some of the mining areas of Germany and Australia.

DUNN AND THE G. S. I.

After he came back from his study tour in different countries in 1935, Dunn was appointed to the post of Petrologist of G.S.I. During 1935–38, he designed and fabricated equipment for the preparation of polished sections of ore-minerals. Thus, Dunn was able to establish a well-equipped laboratory at the G.S.I. for the study of ore-minerals under reflected light. It is recognised by all Indian earth scientists that Dunn was a pioneer worker in the field of the microscopic characters of ore-minerals in India, which include the manganese minerals, vanadium-bearing titaniferous magnetite and base-metals. Along with the late Dr. P. K. Ghosh of the G. S. I.,

he applied the ore-microscopic techniques for the study of Indian meteorites and could identify some of the chondritic textures in the bodies of Indian meteorites, which were regarded as new observations. He was again offered the post of Part-time Professor of Geology at the Presidency College, Calcutta, during the year 1936-38.

Dunn was promoted to the rank of Superintending Geologist on 1st of December, 1938 and during this period, he mapped the Kolhan series of Singhbhum and isolated the theme from the original Jone's Iron-Ore Series of Singhbhum. During the Second World War, he worked as the Officer-in-charge of Mica Production Organisation of Bihar. In collaboration with Dr. John Podger, the Mica Insepector of the Joing Mica Mission, appointed by the then Govt. of India, Dunn was able to put forward a very appropriate classification of the commercial grades of mica and their occurrences in different types of Indian pegmatite veins of Kodarma, Rajasthan and Nellore.

Dunn was placed in-charge of the Eastern Circle of the Geological Survey of India in 1943-44 and in 1945, when Dr. Crookshank proceeded on leave, Dunn took over as officiating Director of the Survey. At this time, a proposal for the establishment of a Geophysics Section in the Survey was implemented. Dunn was also interested in problems of Engineering Geology, and in collaboration with Dr. J. B. Auden, he studied the probable dam sites on the Sutlej river at Bhakra, the Mahanadi dam site at Hirakud and the multipurpose high dams of the river Damodar and its tributaries. Dunn also studied the raw materials possibilities for the refractory and cement industries such as fire-clays, gypsum and china-clays.

Throughout his service in the Geological Survey of India, Dunn came in close contact with Sir L. L. Fermor and obtained much inspiration from him in his scientific activities. Fermor was responsible in initiating him into the new techniques for the study of opaque minerals under reflected light and Dunn was able to demonstrate these techniques with great efficiency and perfection. Dunn's contributions to this new field are embodied in his two published papers on the ore-minerals of Badwin mines, Burma. Later on, he undertook intensive studies of the ore-microscopic characters of the manganese-oxide minerals, particularly Hollandite, Vredenburgite, etc., and was able to publish the results of his investigations in the '*Transactions of the National Institute of Sciences of India*', considered even now, as valuable scientific literature on the microscopic character of the opaque manganese minerals of India.

RETURN TO AUSTRALIA AND RETIREMENT FROM G.S.I.

Dunn proceeded on leave to his home country, Australia, for a period of six months in December, 1945. At the expiry of his leave period, he expressed his desire to retire from the service of the Geological Survey of India on grounds of health. He actually retired on an invalid pension on 3rd June, 1946 after approximately 25 years of service. Before he left India, he submitted to the Govt. of India, a comprehensive report on the expansion of the Geological Survey of India and while on leave, prior to retirement, he was informed about the Govt.'s decision to accept in principle his expansion programme.

On retirement, Dunn was offered an assignment as Mineral Economist by the Australian Government. He showed keen interest in the development of good relations between India and Australia in their mineral exploration programmes. He came to India in 1964, to participate in the XXII International Geological Congress, held in New Delhi and was elected leader of the geological field-trip to the Singhbhum Shear-Zone. With his youthful vigour, he conducted the excursions with the members of the Geological Congress party to the multimineraliferous Singhbhum area over a distance of about 900 km in length and 150 km in width. Unfortunately, he was taken ill at the end of the excursion and had to go to his homeland as an invalid.

HONOURS

The Australian Institute of Mining and Metallurgy conferred on Dr. Dunn the honorary membership in 1943, during the Centenary year of the Institute, in recognition of his valuable service to the cause and promotion of Earth Sciences. He was Vice-President of the Society of Economic Geologists in the year 1938–41 and also in 1943 for Asia. He also acted as Associate Editor of the *'International Journal of Economic Geology'* in 1937 and the Sectional Chief of the *'Annotated Bibliography of Economic Geology'*, during the year 1931–40. He was elected Fellow of the Geological Society of London and was President of the Mining Geological and Metallurgical Institute of India in 1943. He was elected President of the Geology and Geography Section of the Indian Science Congress in 1943. He was also recipient of Govt. of India prize of the Mining, Geological and Metallurgical Institute of India.

PERSONAL QUALITIES

Dunn was very hardworking and expected his colleagues and associates to be equally so. In spite of his outspokenness he was liked very much, largely because of his zeal and enthusiasm. He produced faultless and comprehensive reports which he used to write on the basis of wide field experience and intensive laboratory investigations. He was frank and did not hesitate to ventilate his grievances to his superiors even when they were unpleasant. His hearing was affected during the later part of his life but this did not prevent him doing his work with devotion and relentless zeal. He suffered a mild heart attack while he was in India in 1964 and practically retired from active work during the last two years of his life. On 12th August 1966, while he was holidaying in Queensland with his family he died suddenly, with a massive heart attack.

The development of the copper deposits of India, and the formation of the Indian Copper Corporation at Ghatsila and the copper mines at Mosaboni were entirely due to the untiring effort of Dr. Dunn. His work on Singhbhum copper-belt, was a source of great encouragement to Indian research workers in Singhbhum area. Following his work, it was possible later on to discover many other economic minerals in Singhbhum. Dunn's contributions to different branches of Earth Sciences were remarkable and outstanding. Most of his papers were published in the *'Memoirs and Records of the Geological Survey of India'*. His association with Indian National Science

Academy was very fruitful and as reported earlier, his manganese-ore studies were published in its *Transactions*.

S. DEB

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SHANKAR NATH KAPUR

(1895–1972)

Foundation Fellow 1935

SHANKAR NATH KAPUR was born on 20th August, 1895 at Multan now in Pakistan. His father, Dr. Shiv Nath Kapur, was owner of a well-established wholesale business in medicines and drugs having branches at Multan, Lahore and Karachi. S. N. Kapur spent his school career in Multan and stood first in Matriculation Examination in the then Punjab. He then joined the prestigious educational institute known as Govt. College, Lahore. He married in 1915, when he was only a second year intermediate student. He stood first again in Intermediate in the University. His father died soon after and his father's business firm went into liquidation. They lost all their assets and Shankar Nath found himself in financial difficulties.

CAREER

He was appointed in his college as Student Demonstrator while still doing his B.Sc. at the Govt. College and his wife also got a small teaching job in a local primary school. He again stood first in B.Sc. beating previous records and his name was prominently displayed on the Roll of Honours of the College. He was then a father of two children and further education was out of the question. Hence, he sought a job as a Chemist with Amritsar Distilleries and within a year or so he rose to the position of Manager.

In 1921, the then Punjab Government in consideration of his brilliant educational records, offered him a scholarship for higher studies abroad. It was for the first time that anyone without a post-graduate qualification was offered such a scholarship. Shankar Nath sailed for higher studies in Industrial Chemistry in 1921, obtained a Doctorate from Gôthenberg University in 1923. During this period, he spent nearly nine months at Edinburgh, studying also Botany. He became Associate Member of the Institute of Chemical Engineers, London. While still in Europe, he was selected to join in India as the then highly coveted Secretary of State Services. Consequently, he started working in the Forest Research Institute & Colleges, Dehra Dun, since August 1924 as an "Imperial Assistant".

CONTRIBUTIONS TO FORESTRY

In 1928, he was made Officer-in-Charge of Wood Seasoning Section of the Utilization Branch of the Forest Research Institute and held the post till 1940. Recognizing his knowledge and contributions to the field of wood utilization, and experience of the



Swikarun

properties of Indian woods, his services were specially sought to help the war effort during the Second World War. In June 1940, he was deputed to work with the Ordinance Department of Govt. of India, as Assistant Manager, Rifle Factory, Ichapore, and later as Assistant Manager, Gun & Carriage Factory, Jabalpur. He also served as Officer on Special Duty with the rank of a Director with Timber Directorate of the then Directorate-General of Industries and Supplies of Govt. of India. On his return from deputation, he took over the charge of the Wood Working and Timber Mechanics Branch of the Forest Research Institute as Chief Research Officer.

Dr. Kapur's research activities included studies on collapse and shrinkage of wood during seasoning. He designed furnace-heated kilns and electrical resistance type moisture meters for determining moisture content in wood. This was of great value to the Indian timber trade. He also conducted investigations on certain special unorthodox methods of seasoning such as kiln-drying of wood with ozonised air and the oscillatory method of drying refractory hard-woods. His work on metallization of wood by the vapourised spray technique evoked world attention at that time. His manual on air-seasoning of timber, containing observations on the air seasoning behaviour of 150 species of Indian timbers has formed the basis for the Indian Standard classification of Indian timbers according to their refractoriness to seasoning.

Dr. Kapur himself set up a number of timber seasoning kilns in Government as well as in private organizations. During the period of his working in the Directorate-General of Industries and Supplies, he organized a number of wood-based industries all over India using well-treated, well-seasoned woods for manufacturing war supplies such as ammunition boxes, tool handles etc. The work on finding substitutes for Walnut for rifle furniture and substitutes for imported beech for army boot-lasts was first initiated by him. He had an intimate knowledge of timber industries and remained associated with them almost the whole of his life. He had acquired a great knowledge in the behaviour of Indian timbers and could easily suggest suitable species for various products. He could suggest and design hand operated jigs and fixtures for bending woods, making laminates. Later, he developed formulation of casein and other vegetable protein glues for plywood. During the War, he devised and introduced practical methods to obtain oil-free protein from oil-cakes which were successfully used by many firms in India. By softening and waxing of the Indian deodar, Dr. Kapur used it as a substitute for imported cedar for pencils. He helped bobbin industries by substituting laminated ends and compressed wood for solid timber.

ESTABLISHMENT OF KINLAB

After retirement from Government service on the 20th of August, 1950, Dr. Kapur worked ceaselessly in the field of timber development. He established Kapur's Industrial and Research Laboratories (KINLAB) which was a great source of encouragement to new entrepreneurship to learn about the utilization of Indian woods. The firm supplied over 150 seasoning units to various firms throughout India, including Andaman Islands and Ceylon. He introduced for the first time in India vacuum impregnation plants for traction meters, constant humidity and environment chambers.

Owing to his ingenious methods of developing timber products, he commanded respect and love from many industrialists engaged in seasoning, treatment, fire-proofing, softening, waxing and other fields of wood utilization. He maintained a sizeable library, was a voracious reader and subscribed to many scientific journals and magazines to keep his knowledge up-to-date.

PERSONAL QUALITIES

Dr. Kapur was a very active man, a strict disciplinarian and always practised what he professed and preached. "Early to bed and early to rise" was often quoted by him. He had a flair for truthful and precise expressions. It is hard to recollect an occasion when even in joke a false statement was made by him. He had a high sense of humour and always enjoyed hearing and relating a good joke. He abstained from drinking and smoking throughout his life. Though equipped with a keen intellect, robust healthy habits, a great grasp of fundamentals, Shankar Nath faced a number of personal tragedies which caused his work to suffer occasionally. He was also a good teacher and had taught wood seasoning to a number of officers of forest departments and industrialists of different states. As he was a very pleasant man to talk to, a number of small scale industrialists often flocked around him.

HOBBIES

Dr. Kapur had many hobbies. Chief among them was Homeopathy. He himself cured many intricate cases and loved discussions on the subject with other homeopaths. He used to treat freely about 15 to 20 persons daily on the average. Astrology was another of his hobbies. He was also a very good player of cards, particularly bridge, so as to keep himself engaged in the evenings in his later years. He suffered two massive heart attacks, the first in 1966, the second in 1969 after which he could not be so active as in earlier years.

Dr. Kapur was known among wood scientists as one of the foremost in India and as a person of rare practical bent of mind. He published over 25 research reports and papers of outstanding practical value, some of which are indicated in the bibliography. He died suddenly on the 10th of January, 1972 in Calcutta peacefully, leaving behind his wife, six sons, three daughters, a number of grand children and a host of scientists and industrialists who admired him.

A. C. SEKHAR

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NORMAN LOFTUS BOR

(1893–1972)

Elected F.N.I. 1941

DR. NORMAN LOFTUS BOR, C.I.E., O.B.E., M.A., D.Sc., Sc.D., F.L.S., a distinguished authority on Asiatic grasses, died at the age of 79, on the 22nd of December 1972, at the West London Hospital, after a brief illness. He had a long and distinguished scientific career, both in India and the British Isles, extending over more than half a century, during which he devoted his boundless energy and knowledge to the advancement of botany, to the study, improvement and management of Indian forests, to intensive researches on the Gramineae, to the administration of various institutions and organizations, and above all to humanitarian duties in two world wars.

Bor was a tall, well-built man of powerful physique, with great strength of character, and admirable qualities of generosity, friendliness, courage and frankness. His colleagues and numerous friends the world over will recall his rugged serious face, rapidly broken by a kindly smile, a twinkle in his eyes, and especially by his powerful hand-shake, a grip which the recipient long remembered. He was always glad to assist others with friendly help, wise advice and encouragement, especially over difficult personal or academic problems. Having travelled extensively in Germany and other parts of Europe and having acquired an excellent knowledge of its languages, he was at all times willing to translate, especially from German—a much appreciated service. He always maintained a delightful sense of good humour and of cheerfulness, was a skilful raconteur, so that many will remember the amusing witty stories he so enjoyed telling. His was a very full and happy life in which his strong love of plants, and of fairness in human affairs, played a very important part. He expressed deep satisfaction and thankfulness at being able to accomplish so much, particularly the botanical tasks he had set himself in the Indian Forest Service and at Kew, the completion of which earned him world-wide renown and respect.

EARLY LIFE AND EDUCATION

Bor was born on 2nd May 1893, at Tramore, County Waterford, Ireland, the second son of Edward Norman Cavendish Bor and Mabel Lloyd Bor (nee Thornton), of Kilcoran House, County Kilkenny. His ancestors came from the Netherlands in 1689, with William of Orange (later William III), and settled in Ireland. He was educated at Kilkenny College and at Mountjoy School, Dublin. In October 1911, he entered Trinity College, Dublin, to read for a medical degree but had to give this up when he joined the Army in September 1914. Bor served with distinction throughout the First World War, in the 10th and 16th Irish Divisions, being appointed a Second



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Lieutenant in the 6th Connaught Rangers in September 1914. He was promoted Lieutenant in April 1916 and to Captain in February 1917; he was released from the Army in November 1919. During this period, he was on active service in France and Flanders from December 1915 to September 1916 when he was severely wounded. Later, he served in Macedonia and in Palestine from April 1917 to September 1918. Bor completed sufficient courses to be awarded a B.A. degree in arts in 1921. In 1927, he received the M.A. degree of the University of Dublin and in 1948, the Sc.D. degree was conferred on him for his several taxonomic and ecological publications on the grasses and vegetation of Assam. After release from the Army, he commenced studies in October 1919 in the University of Edinburgh, receiving the B.Sc. degree in the Department of Forestry in July 1921, and in December 1930, he was awarded the D.Sc. degree by this University for a Thesis on the Synecology of the Naga Hills Forests, Assam.

INTEREST IN SPORTS

From childhood and especially during the University days, he took keen interest in various sports activities, particularly rugby football, cricket, tennis and boxing. He was a good all-rounder at cricket and his skill in this game will long be remembered at Kew where, in 1936, he made the record score of 123 not out and of 151 at Dehra Dun in 1940 for the Staff side vs. Staff and Students of the Civil Engineering College, Roorkee. Although a serious heart condition forced him to withdraw from such games when he left India in 1946, his interest in them continued unabated, and he derived much pleasure from watching special events in the open or on television until a few weeks before his death.

MARRIED LIFE

In 1931, while in Assam, Bor married Eleanor Constance Rundall, a charming and talented lady who contributed much to their social activities. They had an exceedingly happy and adventurous life, travelling through many parts of India and Europe, and visiting Malaya, Hong Kong and the United States on their way to Britain on leave. In her very entertaining book, *'The Adventures of a Botanist's Wife' (1952)*, she gives a fascinating account of their life and travels, and especially of her husband's work in northern India, illustrated by her own delightful drawings, and by photographs of vegetation, of native peoples, and of themselves. Mrs. Bor died on 14th April 1957, after a long and exhausting illness. Her ashes, and later, those of her husband, were scattered in the Kew Azalea Garden at their special request. A garden seat, presented by the Bentham-Moxon Trust in Bor's Memory, has been placed near the beds of Grasses at Kew.

BOR'S SERVICES TO INDIAN FORESTRY

Bor joined the Indian Forest Service in December 1921, and during the following twenty-five years he occupied many important Forestry, Botanical and Administrative

posts before his retirement in 1946. At first he was stationed in Assam, in charge of vast areas of forest and was engaged in selecting forests for felling and in the preparation of plans for their regeneration. This work as a Forest Officer brought him into contact with several different native tribes where his flair for languages proved most valuable, as it did in later life. In fact, his wife testified that he could converse effectively in as many as seven tribal languages of Assam by the time of their marriage in 1931. Wherever he was posted he soon acquired a good working knowledge of the local languages, and prepared vocabularies and grammars of them, several of which were eventually published. He was keenly interested in the vegetation of the forests and in their general natural history, and had many exciting experiences with wild animals of the jungle. For a time he kept a stray baby rhinoceros which he first fed with a bottle. When it became too big it was sent to the Paris Zoo; years later when he and his wife visited the Zoo, the rhinoceros still remembered them. He also hunted and purchased elephants for use in the forests. Bor's knowledge of the country and its people led to his appointment as Political Officer of the Balipara Frontier Tract from 1931 to 1934, and his duties were combined with those of Divisional Forest Officer. In 1935, he officiated as Deputy Commissioner of Forests in the Naga Hills, and from 1936 to 1937 he was Forest Botanist and Silviculturist at Shillong, where he revised the herbarium collections. These duties were followed by five happy and productive years as Forest Botanist at the Forest Research Institute, Dehra Dun, where the use of the large herbarium and library enabled him to prepare and publish several papers on grasses and other plants. For several years he gave courses on forest botany to the College students, and he took a very active part in the social life of the Institute, where he was very popular. During this period, he acted for a time as President of the Institute and Inspector-General of Forests, and for a year edited the *'Indian Forester'*.

In April 1942, Bor was recalled to Assam for urgent special duties in the part of the country he knew so well. At first he was posted to the Naga Hills to take on administrative duties connected with the war effort, but in a short time he was appointed Chief Administrator of the Burma Refugee Organisation, based in Shillong, to deal with the refugees pouring into Assam from Burma. Later, in 1944-45, he became Director of the Assam Relief Measures, a body set up for the rehabilitation of the peoples in the Naga Hills and Manipur State. This strenuous work entailed incessant and often dangerous travelling between Shillong and the Burma frontier. It demanded outstanding qualities of leadership, physical endurance, drive and tact, all of which Bor possessed in abundant measure. It was due to his energy, determination, organizing ability and his intimate knowledge of the country and its people, that these difficult tasks were successfully accomplished. He retired in 1946 from service in India with the rank of Conservator of Forests and returned to Britain for a well-earned rest, to find a new home, and a post where his extensive knowledge and experience were of value in the botanical field.

Bor was appointed Assistant Director of the Royal Botanic Gardens, Kew, in May 1948, a post he occupied with distinction until September 1959. At Kew, his very considerable administrative ability and scientific knowledge were fully utilized, for in those days he often not only deputized for the Director but also edited the

'*Kew Bulletin*'. He supervised the finances of the establishment, the education of the Student-Gardeners, served on Selection Boards and Committees, besides dealing with the day-to-day scientific correspondence of the Gardens. Despite his heavy schedule of work, he was always cheerful and helpful, and in the evenings found time to continue his botanical researches in the Herbarium.

He first came to Kew in the summer of 1936, having been instructed by the Government of Assam to prepare an account of the grasses of that province. He brought with him an extensive collection of Assamese grasses, the majority of which he had collected and these, together with the Kew collections, provided an excellent basis for his investigations. He applied himself to this work, an unusual task for a forest officer, with great enthusiasm, energy and concentration, so that within about three months he had acquired a very good knowledge of the structure and classification of these valuable plants. By the time of his return to India he had prepared a '*List of the Grasses of Assam*', published in 1938, and the draft of his account of them, published in 1940, as volume five of the '*Flora of Assam*'.

These investigations at Kew into grass structure and classification stimulated and intrigued Bor so much that he continued research on these plants in India, studies which gradually expanded on his return to Kew as Assistant Director. There, during his leisure hours mainly in the evenings, he revised the genera of the Indian grasses in the Herbarium, examined the types in other British and in overseas herbaria, monographed several of the taxonomically difficult genera, including *Arundinella*, *Cymbopogon*, *Digitaria*, *Dimeria*, *Microstegium* and *Poa*, described numerous new genera and species from Asia, and named large collections from many parts of India, all of which enabled him to correct numerous errors of identification and bring the nomenclature of the Sub-continent's grasses up-to-date. In 1960, the fruits of these many years of thorough and patient labour were published in his '*Grasses of Burma, Ceylon, India and Pakistan*,' thus fulfilling his aim and ambition to provide these countries with a modern treatment of their grasses. A facsimile edition of this indispensable work, with corrections and additions, was issued after his death.

While his studies of Indian grasses were in progress, the Floras of Cyprus and of Iraq were being written at Kew, and Bor gladly undertook the preparation of the accounts of their Gramineae. That for Iraq, a fine well illustrated volume was published in 1968, while the Cyprus account still awaits publication. After his retirement from the Assistant Directorship in 1959, Bor laboured daily and willingly on his agrostological work, thoroughly enjoying his freedom to work in the Herbarium. Despite advancing years and spells of ill-health, he was delighted to revise and write accounts of the Gramineae for Dr. K. Rechinger's '*Flora of Lowland Iraq*' (1964) and for his '*Flora Iranica*' (1970), both of which he accomplished in a praiseworthy manner and to his great satisfaction. In addition to these extensive floristic works, Bor determined numerous Asiatic collections sent to Kew for naming. He has many other scientific publications to his credit, including numerous studies of grasses in the '*Indian Forester*', '*Journal of the Bombay Natural History Society*', '*Kew Bulletin*', and other Journals. He also wrote a '*Manual of Indian Botany*' (1953) for the benefit of his forestry students, and collaborated with the present author in the preparation of a book on '*Some Beautiful Indian Climbers and Shrubs*' (1954).

Bor travelled extensively in many parts of Asia and Europe, particularly in Assam, the Gangetic Plain, and North West India, and visited Lahoul, Sikkim and Tibet, in the company of the present author, making valuable botanical collections, mainly of grasses, which are now deposited in various Indian and British herbaria. His wife gave a most interesting account of their journey to Lahoul in an article 'Land of Hopeless Glory' in the *Indian Forester*, 67 and 68 (1941-42).

HONOURS

For his outstanding services in India, Bor was awarded the C.I.E. in 1945, and for his botanical researches he received the 'Paul Johannes Brühl Medal' from the Royal Asiatic Society of Bengal in 1945, the O.B.E. in 1957, and the 'Gold Medal of the Linnean Society of London' in 1962. He was a member of several British and Indian learned societies, President of the Botanical Section of the Indian Science Congress in 1942, and of the Indian Botanical Society in 1945.

QUALITIES

Dr. Bor was very human and humorous. Innumerable instances of his personal benevolence, jovial disposition and witty conversation are narrated by Mrs. Bor in her book '*Adventures of a Botanist's Wife*'. It is within the present author's personal knowledge that even after his retirement he used to send monthly by money order or through the present author substantial amounts to a dozen persons who served with him or under him in Assam or Dehra Dun. Bor had wide correspondence with agrostologists and taxonomists all over the world and was very prompt in answering even intricate enquiries. The present writer can personally testify to this as he used to correspond with Bor frequently. He used to write a very bold hand with big loops and connectives, sometimes covering a whole page.

A kindly personality with a keen sense of humour, he will be remembered for long in our country for his eminent services to the cause of Indian forest botany and agrostology in particular.

M. B. RAIZADA.

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KRISHNA DAS BAGCHEE

(1898-1973)

Foundation Fellow 1935

KRISHNA DAS BAGCHEE, a pioneer research worker in Mycology and Forest Pathology in India, died at the age of 75 on January 6, 1973, after a short illness.

Krishna Das, son of Dr. Kali Das Bagchee, was born at Tanti Bandha, Pabna District, now in Bangladesh, on the 19th of January 1898. He was a well-built man of good physique, with a great strength of character, generous, hospitable and friendly. He always maintained a sense of good humour and cheerfulness and many will remember the amusing witty stories he so enjoyed narrating, especially when he was in the company of youngsters.

EDUCATION AND CAREER

Dr. Bagchee had a brilliant academic record. He passed M.Sc. in Botany in 1918 from the Calcutta University standing first class first in order of merit and was awarded the '*University Gold Medal*'. '*Sir T. N. Palit Foreign Scholarship*' of the Calcutta University was awarded to Bagchee and this enabled him to work at the Imperial College of Science and Technology, London, where he obtained the D.Sc. degree in cytology and genetics. Dr. Bagchee was also the recipient of '*Marshall Scholarship*' in 1925-26 for research in Biology at the Imperial College.

Bagchee started his career in 1927 as Forest Mycologist in the Forest Research Institute, Dehra Dun, and later became Forest Botanist and also Chief Research Officer of the Pathology branch when it was split from the Botany branch.

CONTRIBUTION TO FORESTRY

He organised research on forest diseases for the first time in the country by establishing the laboratory and starting the Mycology Herbarium, Museum and also the Culture Collection, all of which were continuously expanded through rich collections he used to make during his numerous and extensive tours of the forests. He conducted intensive studies on taxonomy, ecology, physiology and pathology of lignicolous fungi attacking trees and felled timber. He did pioneering work on the biology, taxonomy and control of rust fungi on Indian conifers. He carried out detailed investigations on diseases of 'sal' from extensive field studies with particular reference to root-rot and heart-rots which cause considerable damage and economic loss to forests and suggested measures to control such diseases. The results of his researches are embodied in several publications. Dr. Bagchee took keen



Shaghen

interest in teaching Forest Pathology to the students in the Indian Forest College. Many of the present day senior Forest Officers of the country take pride in having been Dr. Bagchee's pupils.

In 1955, Dr. Bagchee retired from the Forest Research Institute but soon, in July 1956, he was entrusted with initiating botanical research in Jammu and Kashmir State and was its Director for about two years up to June 1958 when he did commendable organisational work. He finally retired from service and settled down in Dehra Dun. However, Dr. Bagchee continued to take keen interest in research activities of the Forest Research Institute, particularly in forest disease research. In recognition of his work, the Government of India honoured him by conferring on him the Emeritus Professorship of the Forest Research Institute and Colleges. For his meritorious services for over 25 years as a scientist, Dr. Bagchee was also awarded the '*Jubilee Medal*' on the occasion of Golden Jubilee Celebrations of the Forest Research Institute in December 1956.

EXTENSIVE TOURS

During the period of his service, Dr. Bagchee undertook extensive tours in the forests particularly in the N.W. Himalayas, making valuable collections to enrich the Mycology Herbarium. Dr. Bagchee travelled widely abroad during the twenties and later in 1948 when the Govt. of India deputed him to attend the Mycological Conference in London and for visiting different laboratories in the United States, Canada and Europe.

HONOURS AND DISTINCTIONS

Dr. Bagchee was associated with several learned and scientific societies and institutions in India. He was a Foundation Fellow of the National Institute of Sciences (now Indian National Science Academy), President of the Botany Section of Indian Science Congress Association in 1939, President of the Indian Botanical Society in 1946 and President, Indian Phytopathological Society in 1955. The Asiatic Society of Bengal honoured him with the '*Barclay Memorial Medal*' in 1954 for his valuable contributions to research.

QUALITIES

His bubbling enthusiasm was a source of inspiration to all who came in contact with him. Dr. Bagchee loved the good things of life and gardening was one of his prime hobbies. He was fond of taking long walks and this kept him fit and in trim condition. His memory was phenomenal and his anecdotes of life had an air of freshness about them. He married Sumati Bhandarkar, and had one daughter and two sons.

A kindly personality with a keen sense of humour, Dr. Bagchee will be for long remembered in the Forest Research Institute and elsewhere in this country for his eminent services to Indian Forest Pathology.

M. B. RAIZADA

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RAO BAHADUR BACHALLI VENKATESACHAR

(1879-1972)

Foundation Fellow 1935

BIRTH, PARENTAGE AND FAMILY LIFE

BACHALLI VENKATESACHAR was born on 18th June 1879 at Chikkaballapur town, Kolar District of the then Princely State of Mysore (now Karnataka), in an orthodox Brahmin family. His father Shri Vyasarayachar was a leading lawyer of that town and his mother was Smt. Achamma. Even from childhood Venkatesachar must have been greatly influenced by his mother, a gracious lady known for her devotional and religious bent of mind and generous nature. His grandfather Chaturdasa Vidya-Chakravarti Lakshmanachar was a famous *Asthan Vidwan* at the Court of Mummudi Krishnaraja Wodeyar, Maharaja of Mysore, and was well known for his erudition in Sanskrit and his deep knowledge of the Dwaita philosophy of the great Madhvacharya. This family tradition had a great influence on Venkatesachar even in his younger days, and explains why, after retirement from his scientific career, he took keen interest in Dwaita philosophy, making valuable contributions to it, and encouraging innumerable institutions and individuals engaged in religious and philosophical pursuits. As was the custom in those days, he was married very early in 1892 to Smt. Padmavati Bai from Hospet, and lived a long and happy life as a *Grihasta*.

He has three sons and a daughter. The first son, Dr. B. V. Raghavendra Rao, himself a distinguished worker in Physics, was Assistant Professor of Physics at Central College, Bangalore, before becoming the Librarian at the the Indian Institute of Science, Bangalore. Later, he was University Librarian and Head of the Department of Library Science at the University of Delhi. At present, he is connected with the Institute for Social & Economic Change, Bangalore, as Honorary Library Adviser. Prof. B. V. Narayana Rao, his second son, has been Professor of Physics and Principal of Vijaya College, founded by his father. His third son Prof. B. V. Krishnamurthy is now the Head of the Mechanical Engineering Department, having served two terms as Principal of the Manipal Institute of Technology. He is also currently Dean of the Engineering Faculty of the Mysore University. Professor Venkatesachar's Son-in-Law, Mr. G. M. Krishna Murti, is a Retired Superintending Engineer of the Karnataka Electricity Board.

SCHOOL AND UNIVERSITY EDUCATION

His earliest education was at Chikkaballapur in the Gurukul of Sri Subba Bhatta who initiated him into the study of Sanskrit. Later, he started his English education



B. Venkataswamy Aiyar

in the High School at Chikkaballapur. In addition to acquiring a good knowledge of English, he showed keen interest in elementary mathematics and science. At the early age of 13, he passed the Matriculation Examination in 1892, and remarkably enough, out of the 12 students who appeared for that examination from that High School, he was the only one to secure a pass. He then joined the Central College to study in the F. A. and B. A. classes. He speedily showed that he was one of the best students of his class, by carrying the 2nd prize in the Junior F.A. class, in 1894. Next year, he passed the Madras University F. A. Examination from the Central College, securing a first class and gaining one of the Government Special Scholarships. He continued to maintain his position in the B. A. classes also, for he gained the first prize in the Junior B. A. class and the Senior B. A. class also. He not only passed the University Examination for the B. A. Degree in all the three branches at the very first attempt, but also took a Second Class in English and a First Class in Physical Science, standing second in rank for the whole of the Madras Presidency and gaining the Government Physical Science Prize of Rs. 100/-. As testified by Prof. Cook, the then Principal of Central College, he was a model of regularity in his attendance, of earnest attention to his work and of modesty in his demeanour. On the recommendation of Prof. Cook, the Government of Mysore awarded him a Scholarship to proceed to Madras for the Master's Degree in Physics. He joined the Presidency College, Madras, and in 1900 took his Master's Degree in Physics, being the only one to do so, in the batch that appeared in that year. It is worth recording, that as a student of the Central College, he was a contemporary of some brilliant men who later distinguished themselves in many walks of national life. Prominent among these was the great son of India, Chakravarti Rajagopalachari, or Rajaji as he is known to millions of his countrymen. Rajaji's intimate friend, Navarathna Rama Rao, also a contemporary of Venkatesachar, wrote to him a warm letter of congratulations on his 80th birthday, recalling a friendship between them of 60 years' standing.

PROFESSIONAL CAREER

Almost immediately after passing his M. A. Degree Examination, his services were availed of, for work in the Central College. When Professor Cook, Principal and Professor of Physics, went on leave for 3 months from 30th of June, 1900, the Government of Mysore appointed Venkatesachar as a temporary Lecturer in the Physics Department for this period. He was made a permanent Lecturer in 1903, and looking back three quarters of a century, it is historically interesting to note that the G. O. on this appointment stated "Government are pleased to sanction the proposed appointment of Mr. B. Venkatesachar as an additional Science Assistant in the Central College. He will be placed in class III of the Educational Officers on a starting pay of Rs. 130/- a month." Perhaps there was no Class D or a Class C in those days ! Thus Venkatesachar literally rose from the lowest rung of the ladder in his professional career as a teacher of physics. During the short period of four years from 1903 to 1907, in which year Prof. Cook retired, he made his mark as a successful lecturer, and consequently there were no hurdles to his attaining higher status in his official capacity. In 1908, Dr. E. P. Metcalfe, a brilliant student of the

University of London, who had made original contributions to Physics both in London and at Cambridge, where he worked in the Cavendish Laboratory under J. J. Thomson, was appointed Professor of Physics in the Central College in the place of Prof. Cook. This appointment coincided with the reorganisation of studies by the Madras University to which the Central College was affiliated, and this reorganisation resulted in the introduction of the Intermediate and B. A. courses with practical work in science subjects. Venkatesachar was of great help to Prof. Metcalfe in planning and building the Department of Physics on sound lines, and the Department was well equipped for work in 1912. Later, the founding of the Mysore University in 1926, thanks to the foresight of Sir M. Visveswaraya, gave a further impetus to advanced work and research in the Department and a natural corollary of these activities was the promotion of Venkatesachar as an Assistant Professor. When Dr. Metcalfe was appointed as Principal in 1917 in addition to his duties as Professor of Physics, the need naturally arose for a full time Professor of Physics to look after the Department, and in course of time Venkatesachar was the natural choice for this Professorship. The reputation of the Department while he was Professor was such that Prof. C. V. Raman thought fit to announce the discovery of the Raman Effect, at a historic lecture, delivered under the auspices of the South Indian Science Association on 16th March 1928, in the lecture hall of the Department of Physics of the Central College, which lecture hall is now appropriately named the Raman Lecture Hall. When Dr. Metcalfe was appointed in 1929 as Vice-Chancellor of the Mysore University, Venkatesachar was promoted to a full University Professorship. He also acted for sometime as Principal of the Central College during the year 1930. It was in this year, that he presided over the Physics Section of the Indian Science Congress Session held in Allahabad, and came into contact with many distinguished Physicists of the country including Meghnad Saha. It was in the same year, that the title of "*Rao Bahadur*" was conferred on him by the then British Government at the centre, in recognition of his eminence as a Professor of Physics, and his devoted service to the cause of education in the Mysore State. When this distinction was conferred on him, the members of the Staff of the Physics Department of the Central College presented him with an Address in which they acknowledged in glorious terms the service rendered by him to the University, by training a generation of students. It was also pointed out in that Address that he was the first Professor to be so honoured in the Mysore University. It is correct to say that he was the first and the last Professor of the University in the Science Faculty to receive such a signal honour from the Government of India. Rao Bahadur Venkatesachar was elected a Fellow of the Institute of Physics (London) in 1932. Meghnad Saha supported his case, and in his letter to Venkatesachar intimating this support, Saha remarked "*Your name should be proposed for the Fellowship of the Royal Society. Why should you want this poor thing?*" This shows the high esteem in which he was held by many of the distinguished Physicists of the day in India. After a close association of 35 years with the Central College, and after throwing all his initiative, his untiring energy and enthusiasm in building up and nourishing the Department of Physics, he retired from the University in 1937. On 18th June 1937, he was presented with an Address by the members of the Physics Staff of the University praising his qualities of head and heart,

and his distinguished service to the cause of teaching and research in Physics.

Even after retirement, he did not completely sever himself from his activities as an educationist. He served for two years as Acting Director of the Indian Institute of Science, Bangalore from 1937 to 1939. He founded the Bangalore High School in 1942, and was for a long time President of the Managing Committee of that Institution. He also founded the Vijaya College in 1945, and was Principal of that Institution from 1945 to 1951. On the occasion of his 70th birthday in June, 1949, both these institutions presented him with an Address eulogising his services to the cause of education in the State.

Throughout his career in the University, Venkatesachar had the reputation of being a devoted teacher, and a scintillating lecturer. His associations with his colleagues were always cordial, and many of them have acknowledged his generous attitude towards them in encouraging research. Specially when teaching small classes, those for Honours and Master's Degree, he followed a unique technique characteristic of him. After a few lectures embodying the introduction of a subject, he gave them a list of references and urged them to study the relevant topics in those books. Later, he would sit with the students on the bench, and ask them to explain what they had studied, enquiring at the same time about the difficulties they had encountered in understanding particular aspects. In order that all the students might participate in this novel exercise, he would distribute numbered billets to them and call at random the numbers of the respective students to the Board to explain points which they had studied. There used to be a joke among his students in those days, of course outside class hours, as to the number of billets he used, some maintaining that it was equal to the number of elements in Mendeleef's Periodic Table, and others maintaining that it only went up to 77 the atomic number corresponding to Iridium, since Venkatesachar himself had done some valuable work on Iridium Isotopes ! Almost every Saturday in the week, Colloquia were arranged in the Department in which the staff, advanced students and research workers participated and discussed several topics of current interest. Some of his other mannerisms were to sit on the table and at other times moving among the students themselves. He was at times a little short tempered, when unnecessarily annoyed. No student who took a difficult problem to him for solution, came back disappointed, for he took great pains in resolving the difficulty to the satisfaction of the student. He has been loved and respected by a whole generation of students, among whom special mention may be made of the well-known Kannada literateur, Masti Venkatesa Iyengar, Drs. S. Subba Rao and B. K. Narayana Rao, and H. V. R. Iyengar, former Governor of the Reserve Bank of India.

RESEARCH WORK

The scientific work of Venkatesachar may be broadly described as experimental spectroscopy, based on theoretical ideas of Bohr's old quantum theory. This work can roughly be classified under three headings, viz., (1) Analysis of atomic spectra, (2) Raman Effect and (3) Hyperfine structure of spectral lines in relation to nuclear structure. In all this work, he was ably assisted by his colleagues Drs. Sibaiya and Subbaraya.

His earliest papers in collaboration with Dr. Metcalfe published in the *Proceedings of the Royal Society* related to the absorption of light by luminescent vapours. This work having an important bearing on Bohr's theory of spectral variation attracted the attention of many physicists of the time. Thus, these experiments were repeated in the University of Toronto, Canada, by McLennan and others who confirmed the results obtained in the Central College Physics Laboratory. Of work on this topic, special mention must be made of two papers published by Venkatesachar in the *Philosophical Magazine*, **XLIX**, 1925, and in the *Proc. R. Soc., A.*, **117**, 1927. In these papers he described the influence of the length of the radiating column on the width of spectral lines and the density of the vapour in the mercury arc and the relative intensities of the radiated spectral lines with special reference to the forbidden line 2270. These two papers show clearly how the Bohr theory could explain satisfactorily the numerous spectral lines obtained under various experimental conditions.

This work of Venkatesachar published in the *Proc. R. Soc., A.*, **117**, 1927 indicating the results of changes in the density variation led to an important paper in collaboration with T. S. Subbaraya on the First Spark Spectrum of Mercury published in the *Zs. f. Phys.*, Bd. 5, 1931. This paper was also the catalyst for further work of Subbaraya on several spark spectra and of B. V. Raghavendra Rao on the Spark Spectra of Gold, Au II, Copper, Cu III and Silver, Ag III.

Soon after the discovery of the Raman Effect, Venkatesachar interested himself in this new phenomenon, and devised in collaboration with Sibaiya a new type of a very effective apparatus for the study of the effect. This apparatus has been described by Köhler in his well-known book on the Raman Effect, and was used for the study of a number of substances, examining in particular, the wings accompanying the Raman lines.

Perhaps the most significant contribution of Venkatesachar to physics was the study of the structure of spectral lines in relation to the properties of the nucleus. This subject he chose for his Presidential Address of the Mathematics and Physics Section of the Indian Science Congress Session at Allahabad in the year 1930, entitled "The fine structure of spectral lines in relation to selective absorption." Based on the experimental work set forth in this address, he proceeded in collaboration with his colleagues to determine the isotopic constitution and the nuclear spins of the elements Platinum, Iridium and Gold, which had for a long time resisted the attempts of Aston and others to obtain their isotopic constitution by means of the mass spectrograph. Suggestive papers were also published later on the constitution and magnetic moments of atomic nuclei.

The quantum theory was only in its early stages of development at that time, and no real relativistic quantum theory then existed. Also the experimental results relating to elementary particle and nuclear physics were very meagre. Considering all this, Venkatesachar's work at that early stage which brought forth clearly the necessity for further theoretical and experimental work in the domain, was certainly a rich tribute to his physical insight and his work certainly makes worthwhile contributions to experimental physics.

RELIGIOUS AND PHILOSOPHICAL PURSUITS

No biographical memoir of Venkatesachar would be complete without a reference to his activities in propagating *Dwaita* philosophy. After being a scientist during the first half of his career, he was an Acharya in the real sense of the term, during the second half from 1940 to 1972. Even when he was a Professor in Central College, he took keen interest in Sanskrit and was President of the Sanskrit Association of the College. He made a deep study of several facets of Indian philosophy, the *Advaita* of Shankaracharya, the *Vishishtadvaita* of Ramanujacharya and specially the *Dwaita* of Madhvacharya, of which sect he was a devout follower. He was responsible for the founding of several Madhva Sanghas in the State, and earned the great regard of several Heads of Madhva Mutts. Sri Pejavar Swamiji who founded the Purna Pragna Vidya Peeth appointed him as the first Vice-Chancellor of this Institution. He arranged several Seminars and Symposia devoted to the Vedas, the Upanishads, and the *Bhagavad Gita* in which many learned scholars participated, while he himself took keen interest in these activities by initiating these discussions. The number of scholars who benefited by these activities is legion, and they always remember his initiative and his creative contributions in this direction. He was himself the author of several treatises and articles numbering nearly 50. As a sample of those published in English we might mention his works on '*Dwaita Vedanta and Life*', '*Sri Madhvacharya and his Message*', '*The Monism of Shankara*', '*The Nature of the Parabrahman as depicted in the Gita*', '*The Genius of Jayathirtha as a Commentator of Dwaita Philosophy*', '*Vedanta and Modern Science*' and '*Religion and Science*'. This memoir is perhaps not the proper forum to deal with his other numerous contributions to religious and philosophical topics, and the very active and dynamic part he played in propagating *Dwaita* Philosophy.

In recognition of his great services in this direction, the Head of the Vyasaraya Mutt conferred on him the title "*Sachshastra Pravachana Ratna*", the Head of the Raghavendra Mutt the title of "*Vidya Vachaspati*", the Head of the Bhandarkere Mutt the title "*Madhva Bhushana*" and the Head of the Pejavar Mutt the title "*Shastra Nidhi*".

Having earned so many honours, in the fields of religion, philosophy and science he lived a long and happy life of 93 years, and breathed his last on 27th May, 1972.

Great tributes were paid to him by many of his students, friends and admirers. As a sample we might give an extract from the condolence message of C. Rajagopalachari.

"It was sad news that I read. Venkatesachar was my class mate and was much better in his studies than I was. Both of us were of the same age. I followed his brilliant career without personal contact, and was very glad to note it. He was a pious devotee of the Madhva philosophy and set an example of godly living with science up to the brim in his head. My condolences to the family and best wishes to them all".

ACKNOWLEDGEMENT

The present writer wishes to acknowledge with thanks the help rendered by Dr. B. V.

Raghavendr Rao, his eldest son, in supplying me with numerous details which have helped me in writing this biographical memoir.

B. S. MADHAVARAO

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Wm. 193

MANINDRA NATH DE

(1892–1974)

Elected F.N.I. 1942

MANINDRA NATH DE was born in April, 1892 in Shibnandanbati in the District of Howrah, West Bengal, in a rural family. He lost his father Mahadev De, when he was barely eight years old. He was thus left under the care of his mother Narayani De and his elder brother Upendra Nath De twenty years older than him.

EARLY LIFE AND EDUCATION

De had to face a strenuous and hard life in his early career. He overcame these hurdles and difficulties by dint of sheer determination and high ideals. He studied in the local high school and passed the Entrance Examination with credit in 1910. He then came to Calcutta for higher studies and obtained ready admission to the well-known St. Xavier's College for Intermediate Science. He stood high in the I. Sc. Examination of the Calcutta University in 1912. The Principal of the College was so pleased that he offered De free studentship if he continued his studies in the B. Sc. Honours course.

He applied for admission to Calcutta Medical College, the only College then in Bengal for Medical Education, and had no difficulty in obtaining admission there. He showed even greater brilliance as a medical student and was a government scholar throughout. In the pre-clinical course, he obtained gold medals in Chemistry(1912–13), Physiology(1914–15)and Pharmacology(1915), and in the clinical course, gold medals in Pathology (1916–17), Medicine (1918) and the '*Goodeve Medal*' in Midwifery and Gynaecology (1918). During his entire career, he acted successively as Class Assistant in Chemistry, Pharmacology, Pathology and Medicine and obtained Honours in Physiology, Pharmacology, Pathology and Medicine in the University examinations. He was also awarded the '*P. C. Chatterjee Scholarship*', for his proficiency in normal and morbid histology and the '*Abdul Ghani Scholarship*' as the best student in the institution.

HIS PROFESSIONAL CAREER

After his brilliant academic career, he served as house physician to the then famous professor and clinician, Col. Calvert. During the tenure of this housemanship a pandemic of Influenza was raging in India. He took the opportunity to study this disease thoroughly and prepared a thesis which was accepted for the M. D. Degree of the Calcutta University but unfortunately the then examiners did not agree to

admit him to the degree as they opined he had not acquired sufficient maturity to hold that honour, and this led to great frustration. He was, however, readily admitted to the Assistant Surgeon's post to the Government of Bengal and was posted in the Department of Pathology and Bacteriology of the College as Demonstrator.

He took the earliest opportunity to go to England on study leave and appeared at the M.R.C.P. Examination in 1926 within three months of his arrival in London and he came out successful in his very first attempt. He utilized the remaining period of his study leave in having higher practical training in Pathology in Prof. Greenfield's Laboratory of the University of London. On his return, he rejoined the post of Demonstrator, Department of Pathology and Bacteriology of the Calcutta Medical College and also served as Honorary Visiting Physician at the Howrah General Hospital. In 1927, he was selected as the first non-IMS Indian to hold the post of Resident Physician (R.P.) in the Calcutta Medical College Hospital. Within two years of this appointment he was selected to hold the post of Professor of Pathology and that of Bacteriologist to the Government of Bengal in which he served for nine years (1929-1937). He then became Professor of Clinical Medicine of the College, a post which was once held by his revered teacher Col. Calvert. Within the next two years he was promoted to the post of Professor Director of Medicine and Presidency Physician to the Government of Bengal and was the first Indian to hold the post at the Calcutta Medical College. He served in this post for ten years till his retirement in 1949.

During this period he also officiated as Principal of the Medical College for a few months and in this short assignment he effected considerable improvement in the diet of the Nurses' hostel and removed invidious distinctions between the European and Indian patients' wards. After retirement, he spent the remaining period of his life in consultant practice with dignity and on strict ethical principles.

Professor De was not only a top ranking clinician who was respected by the profession but also one of the most lovable and eminent teachers of rare ability. His clarity of ideas and methods of presentation were such that they created a permanent impression in the minds of those who had the privilege of listening to him. In his early morning medicine class, the entire group of senior students of the College as well as many from other sister colleges flocked in such large numbers that it sometimes became difficult to suitably accommodate all. Strict punctuality, either in the class or in the hospital ward, was the *sine qua non* of his discipline and he always put greater emphasis on the physical and mental comforts of the patients than those of himself and his house-staff, students and nurses. He insisted that the essential and primary duty of any hospital staff was to look after the patient as best as possible around the pivot of proper diagnosis and adequate treatment.

Students and doctors were always eager to listen to his superb bedside clinics, differential diagnosis and his instruction to maintain bed-head tickets of patients. He took special care in the diet supplied to the patients and was often present at the time of its distribution. He also took interest in his house staff who most often had to stay long hours in the hospital to take care of the patients.

In the Medical College hospitals, he was very popular among all groups of students, patients, nurses and ward staff for his lovable behaviour, sympathy, kindness and encouragement.

MEDICAL RESEARCH AND SCIENTIFIC CONTRIBUTION

Professor De strongly advocated that to maintain the progress of knowledge in Medicine, research should be a constant and concomitant feature of those who either practice or teach medicine and this philosophy he tried to illustrate by his own example. The writer is one of the many whom Professor De inspired and converted into whole time research workers in fundamental fields of medical research.

Professor De's outstanding contribution was his histopathological study of Epidemic Dropsy, then a disease of unknown etiology. His findings indicated a toxic origin rather than infection or vitamin deficiency. He also discovered several new cutaneous manifestations of the disease. Jointly with the present writer he, for the first time, made an extensive review of the history and epidemiology of the disease in which mustard oil was suggested as a probable etiological factor. These findings have been incorporated in Scott's History of Tropical Medicine. His next important contribution was the enunciation of Bengal Splenomegaly with cirrhosis of liver in which he established histopathologically that it was a disease of specific identity not to be associated with the Banti's disease or splenic enlargement of malaria or Kala-Azar and that the disease could be relieved and the life of the patient prolonged by splenectomy. This work was financed by the Indian Research Fund Association. His contribution to the clinical and pathological study of 1917-19 Influenza pandemic was no less important for a disease which was unknown or unrecognised in India prior to this pandemic. His clinical studies covered such wide fields as Kala-Azar, Malaria, Tuberculosis, leprosy, leptospirosis, dermal leishmaniasis, diphtheria, dysentery, uraemia, *pneumococcal peritonitis*, *pfeiffer bacillus meningitis*, *encephalitis*, *septicaemia*, *cellulitis*, silent heart disease, coronary thrombosis, *cancrum oris*, clinical syndrome in *neuromyelitis optica*, salmonella fevers and pregnancy anaemia. He also contributed new knowledge on pathological manifestations of diseases like actinomycosis, rhinosporidia, chordoma, carcinoma, muscle tissue tumours etc., and described certain anatomical abnormalities such as displaced and malformed kidney, foetus with one eye (cyclops) and oxycephaly. His total scientific contributions number around 80, including those jointly with his assistants or colleagues. He published a book on "*Bacteriology in Relation to Clinical Medicine*" which gained enormous popularity among students and teachers all over India.

PERSONAL AND FAMILY LIFE

Professor De's wife came from the well-to-do family of Raj Kishore Kundu. They had seven children (two sons and five daughters).

Eloquent as a speaker, eminent as pathologist, brilliant as scholar and clinician, Professor De endeared himself to students, colleagues and patients both inside and outside the college and hospital. He donated Rs. 50,000/- to found a ward in the Calcutta Chittaranjan Hospital attached to the National Medical College in 1954. He also donated beds to Islamia Hospital, where he served as Honorary Visiting Physician for many years. He also spared his honorary services to the Cossipore North Suburban Hospital. In respectful memory of his beloved teacher Col. Calvert, he

established an annual oration under the title '*Col. Calvert Memorial Oration*' at the Calcutta Branch of the Indian Medical Association.

OTHER ACHIEVEMENTS

In recognition of his contribution to Medical Science, particularly in relation to pathology of tropical diseases he was awarded the '*Coate's Gold Medal*' for Medical research. On retirement from the West Bengal Health Service he was offered the teaching post of Tropical Medicine at the School of Tropical Medicine, London, but he preferred to stay in Calcutta to be helpful to his own countrymen, family and relations.

He was President of the British Medical Association, Calcutta Branch, now defunct. His other scientific connections were as a Fellow of the Royal Society of Medicine, London, International Association of Medical Museum, Montreal, State Medical faculty of West Bengal and Member of the Association of Physicians in India, Calcutta Medical Club and Indian Medical Association. He also served as an Editor of the '*Calcutta Medical Journal*' for some time. This eventful life of 82 years came to an end on the 30th August 1974.

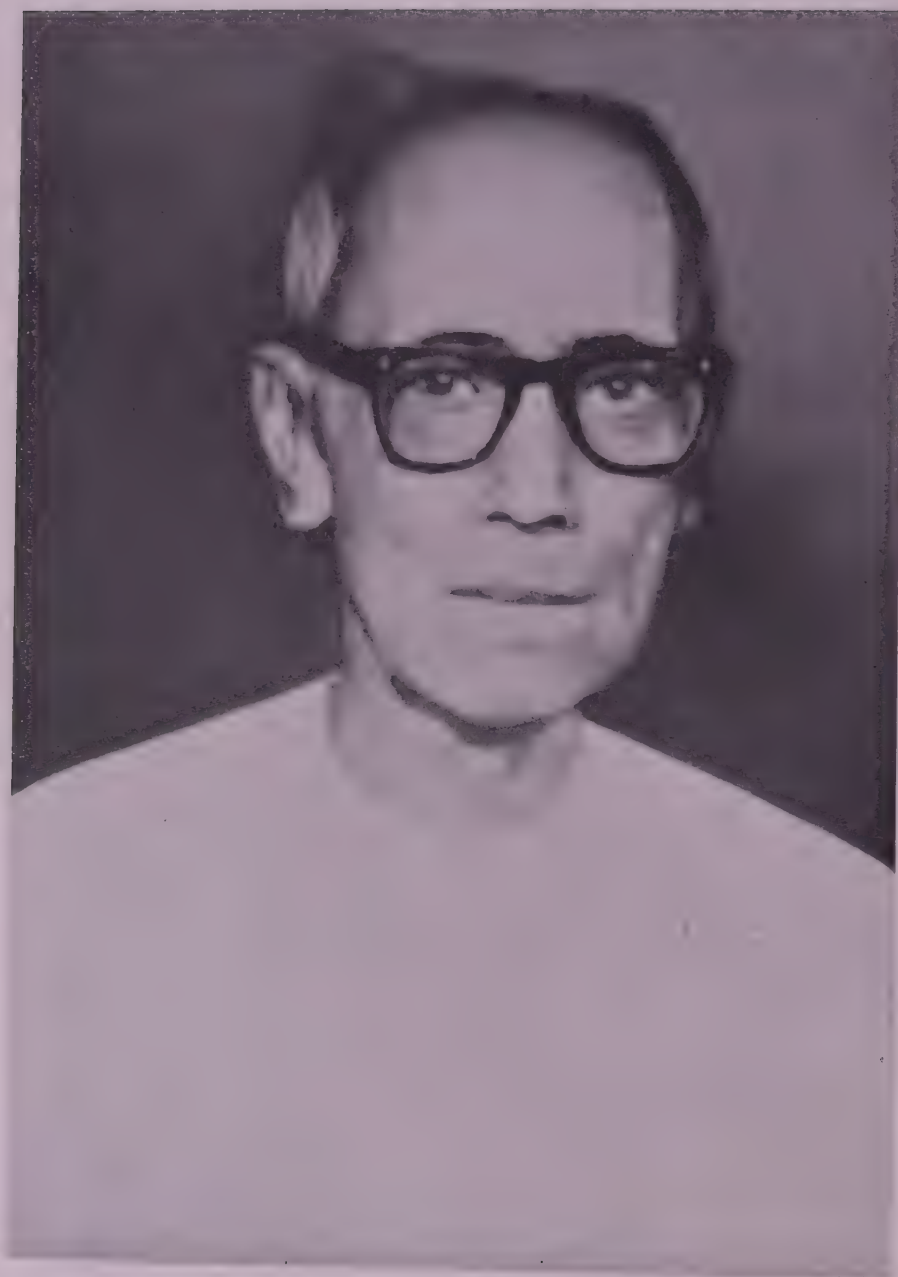
S. C. SEAL

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R. N. Sen

RABINDRA NATH SEN

(1896-1974)

Elected F.N.I. 1954

WITH the passing away on July 19, 1974, of Rabindra Nath Sen, retired Hardinge Professor of Higher Mathematics and Head of the Department of Pure Mathematics, Calcutta University, India lost a distinguished mathematician who achieved eminence by his extensive work on Differential Geometry. Dr. Sen will long be remembered for his valuable research contributions. The bibliography of his published works printed at the end of this memoir will give an idea of the breadth and scope of his research interests.

EARLY LIFE AND EDUCATION

Rabindra Nath Sen was born on 7th January, 1896 in Dacca (now in Bangladesh) in the house of his maternal grandfather, Rai Bahadur Akshoy Kumar Sen, who was at that time a Deputy Magistrate. His father, Jogendra Nath Sen who hailed from Itna, in the district of Jessore, was an Advocate of the Calcutta High Court, a member of the Senate and Syndicate, Calcutta University, and a close associate of Sir Asutosh Mookherjee. His mother, Hemanta Kumari Devi, was a very devoted and pious lady. Dr. Sen was the second son of his parents. His father died suddenly in a car accident at the rather early age of fifty. It was due to this mishap that his mother had to leave Calcutta for Dacca, where Sen had his early education, in the Dacca Collegiate School and Dacca College. After passing the B.A. examination, he went to Poona to serve in the office of the Military Accounts and worked there for about a year. He obtained the M.A. degree in Pure Mathematics of the Calcutta University in Class I in 1920. Sometime after taking his M.A. degree, he engaged himself in research work and published his first paper in the *Bull. Calcutta math. Soc.*, in 1926. In 1928, he went to Edinburgh to undertake research work under late Sir E. T. Whittaker. He was awarded the 'Newton Scholarship' and took the Ph.D. degree of the Edinburgh University in 1930 on the basis of his thesis entitled 'On the newer theories of space'. On returning to India the same year, he worked as a lecturer in Mathematics in Asutosh College, Calcutta, for about two years. In 1933, he joined the Department of Pure Mathematics, Calcutta University as Lecturer. In 1954, he was appointed Hardinge Professor and Head of the Department of Pure Mathematics of the University. He retired from the Hardinge Chair in 1961. It was during his tenure as Head of the Department that many improvements were made. The Department which was under the University College of Arts was brought under the control of the University College of Science. The departmental library was reorganised,

research activities obtained an impetus and the department flourished under his efficient guidance.

RESEARCH CONTRIBUTIONS

Dr. Sen started his research work with the study of the simplexes in n -dimensions and his first paper, as already stated, appeared in the *Bull. Calcutta. math. Soc.*, in 1926. His research activities relate mainly to Differential Geometry of Riemannian and Finsler spaces. He produced a steady output of original papers which form a substantial contribution to Differential Geometry. His work on teleparallelism attracted the attention of eminent geometers like Prof. T. Levi-Civita of Rome.

Sen's investigation on the behaviour of an arbitrary parallel displacement in a metric space resulted in the discovery in 1949-50, of an algebraic system of affine connections in which the Levi-Civita parallelism could be identified. This work is considered as highly significant and is referred to by I. M. H. Etherington of Edinburgh University as 'Senian Geometry'. Prof. Etherington observes :

"A Senian Geometry (g, Γ) determines a system of S - g 's $(g, \Gamma^*), (g, \Gamma'), (g, \Gamma_0 * \Gamma')$, etc., which at first sight, we might suppose to be all distinct from (g, Γ) but it turns out that most of them are not essentially distinct [in this sense : (g, Γ') is not essentially distinct from (g, Γ) because it generates the same system, so that any invariant object of (g, Γ) must also be an invariant of (g, Γ^*) and vice versa].

"However, the system always includes the special Riemannian geometry $(g, \{\})$ and perhaps also other special geometries which are distinct from (g, Γ) ."

The subject matter of this work is contained in the three papers entitled 'On an algebraic system generated by a single element and its applications in Riemannian geometry — I, II, III', which appeared in *Bull. Calcutta math. Soc.*, **42**, pp. 1-13, **43**, 77-94, 177-187.

The algebraic system, mentioned above, was later applied by Dr. Sen to Finsler space. This work together with his other papers on Finsler spaces published during 1967-68 form valuable contributions to Finsler geometry.

Sen's work on new theories of space in general relativity and unified field theory was published in the *Bull. Calcutta math. Soc.*, **56** (1964). This was highly spoken of.

Dr. Sen is also the author of two text-books based on his lectures to the Post-graduate Classes : (i) *A Course of Geometry* and (ii) *Foundations of Geometry*.

The arrangement of the material of the former book was greatly admired by Professor E. T. Whittaker, Professor A. G. Walker, Professor F. W. Turnbull and others who felt that the book brought the teaching of elementary geometry in line with modern views.

After retirement, Dr. Sen worked during 1961-67 on research projects in India with the C.S.I.R. and the U.G.C. During this period, he published a large number of papers. His last contribution was an invited paper for *Colloq. Math.* (XXVI), dedicated to the memory of W. Slebodzinski, Professor, Wroclaw University, Poland. This was published in 1972. A week before his death, bedridden due to illness, he discussed with the writer of this biographical memoir a research paper on Finsler

space and expressed the hope that it might be possible for him to complete the work after recovering from illness.

HONOURS

Professor Sen received many honours and was associated with various learned societies and associations. In 1959, he was elected a member of the Syndicate, Calcutta University, and in 1960 he was appointed Dean of the Faculty of Science. In 1954, he was elected Fellow of what is now known as the Indian National Science Academy. He was elected President of the Mathematics Section of the Indian Science Congress for the session held at Agra in 1956. He was President of the Calcutta Mathematical Society for three consecutive years 1963-66 and was Chairman of the Board of Undergraduate Studies in Mathematics, Calcutta University, for fifteen years (1958-1973).

PERSONAL LIFE

Professor Sen married in 1922 and had a very happy married life. His wife Mrs. Usharani Sen, a grand daughter of Mahamahopadhyay Dwaraka Nath Sen of Pathuriaghata, and of Ambica Charan Majumder, President of Indian National Congress of Lucknow Session 1916, is a lady of great intelligence and strength of character whose devotion and care made it possible for Dr. Sen to pursue his scholarly activities. Dr. Sen is survived by his wife and two daughters both of whom are married.

QUALITIES

A typical Indian in habits, tastes and dress, Dr. Sen was straight-forward, upright and religious-minded. Behind his rough exterior there was a kind heart and those who had the privilege of coming in close contact with him knew this. He believed in hard work, sincerity and punctuality. As Committee Chairman he was dominating and succeeded in carrying his point by the compelling force of his convincing arguments. A capable administrator and a distinguished and respected mathematician, Dr. Sen was also a man of high moral standing and humanistic outlook. His memory will be cherished by his friends, colleagues and students not only for his academic eminence but also for his personal qualities and for his services for the development of science and education in our country.

M. C. CHAKI

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DURAI SWAMI NARAYANAMURTI

(1904-1975)

Elected F.N.I. 1947

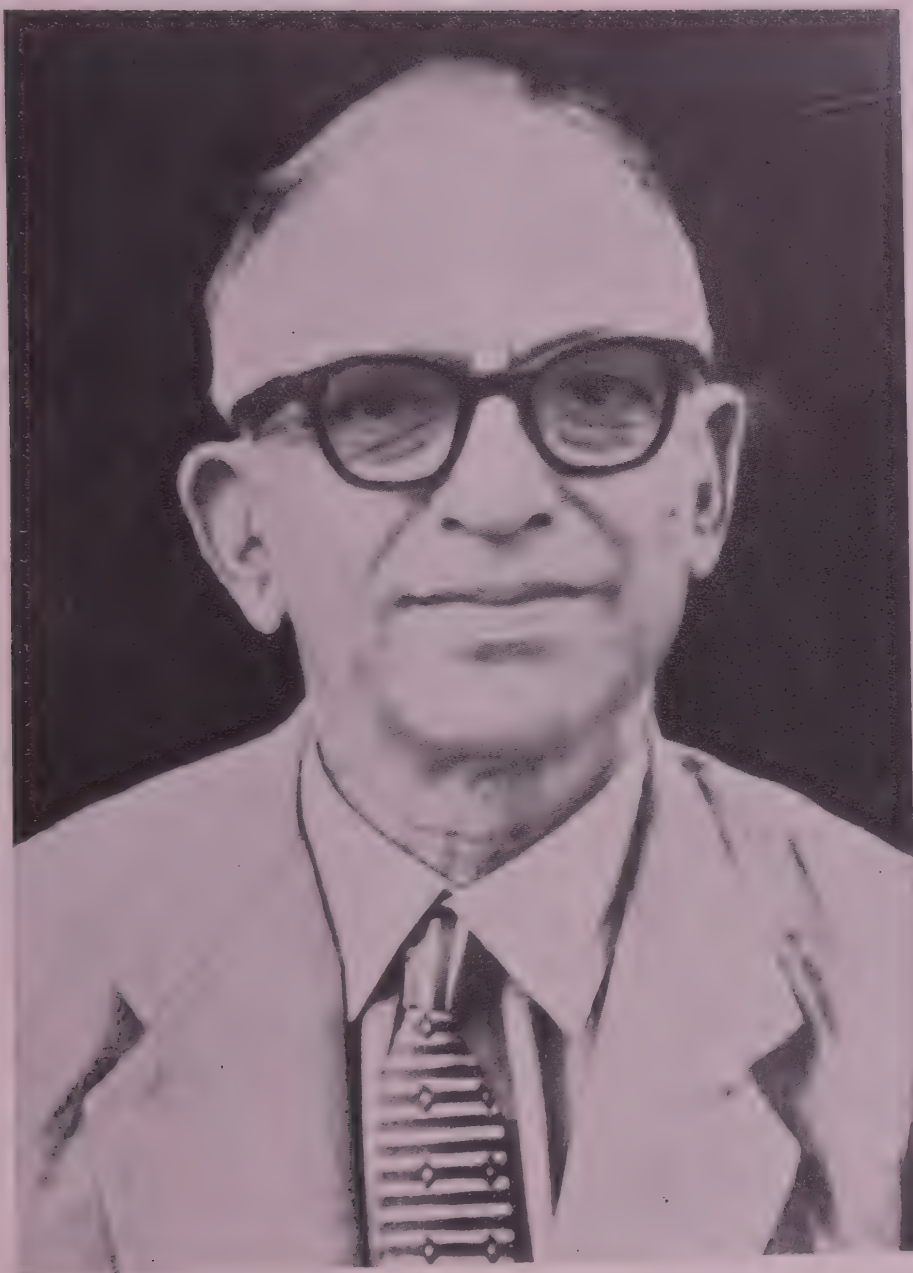
DURAI SWAMI NARAYANAMURTI, the well-known international expert on Wood Science, died on 9th March, 1975 in Bangalore. He was born on 11th September, 1904 at Kumbakonam, Tamil Nadu.

CHILDHOOD

Dr. Narayanamurti belonged to a typical South Indian Brahmin family. His parents, Kapisthalam Ramaswamy Duraiswami Iyer and Seshammal had three sons and seven daughters. Narayanamurti (that was his first name as per the system of naming followed in the South) was the youngest child. His father was respected by a large number of students of mathematics of Government College, Kumbakonam. He retired in 1914 as Professor of History, a subject he learnt at an advanced age, at the Presidency College, Madras. Dr. Narayanamurti was an affectionate and obedient son and was a good student. He was fond of sports, especially football.

ACADEMIC CAREER

Narayanamurti did his S. S. L. C. (Secondary School Leaving Certificate) from the Town High School, Kumbakonam and his Intermediate examination from the Government College, Kumbakonam. His interest in Science was shown at an early age by his preference to continue science studies, for which he was prepared to go away from home, rather than stay in Kumbakonam and do an arts course. He studied at the Central College, Bangalore and took his B.Sc. degree with Chemistry (main) and Physics (subsidiary) in 1925. His interest in Science was again shown when he resigned the post of Demonstrator in the Government College, Kumbakonam on Rs. 65 p.m. to take up a research scholarship in the Indian Institute of Science, Bangalore on Rs. 60 p.m. His father had to supplement this with Rs. 25 p.m. As a result of his studies in the Department of Biochemistry of the Institute under Prof. R. V. Norris, he was able to present a thesis which was accepted for award of the M.Sc. degree of the Bombay University in 1929. He was also awarded the Associateship of the Indian Institute of Science (A.I.I.Sc.) which was recognised as equivalent to an M.Sc. degree. Commenting on his work, Norris said *"In these investigations, Mr. Narayanamurti has shown conspicuous ability and initiative. He is most hardworking, and combining as he does manipulative skill with a sound theoretical knowledge, he has been able to obtain results of marked interest. He is a most enthusiastic*



Charles

worker.” His researches dealt with (1) nature of enzyme action and (2) examination of higher vegetable proteins. His keenness for improving his academic qualifications was again seen when as a young officer of the Forest Research Institute, he took 14 months leave on half-pay to work in the Technical University of Danzig under Prof. Dr. Ernst Schmidt. His thesis on the movement of moisture and heat in wood and other materials was accepted in 1935 for the degree of Dr. Ing. by the Division of Mechanical Engineering of the Technical University of Danzig’s Faculty for Mechanical Engineering, Ship Building and Aeronautics. Commenting on his work, Dr. Schmidt said, *‘Mr. Narayanamurti has carried out his researches in my laboratory with great experimental skill, good scientific knowledge, great thoroughness and diligence and has thereby provided a valuable contribution to the understanding of the phenomena connected with the drying of wood’*.”

PROFESSIONAL CAREER

He started life in 1925 as a Demonstrator in the Government College, Kumbakonam. Principal P. V. Seshu Aiyer, in his testimonial said, *“While here, he has been doing his work with earnestness and diligence and to the satisfaction of his superiors, and he has also endeared himself to the students.”*

From July 1926 to 31st October, 1929, he was a Madras Government Research Scholar on Rs. 60 p.m. in the Department of Biochemistry, Indian Institute of Science, Bangalore. From 1st November, 1929 to 11th April, 1930 he was a Research Student of the Indian Institute of Science on Rs. 120 p.m. the studentship having been “awarded for distinguished work.”

From April to December, 1930 Dr. Narayanamurti was Manufacturing Chemist on Rs. 400 p.m. (with free quarters) in the Government Quinine Factory, Naduvattam (Tamil Nadu). Mr. A. Wilson, the Deputy Director of Agriculture, said, *“He secured the willing cooperation of the factory staff during the period of his stay with me and in other ways showed a capacity for management which will stand him in good stead for the future.”*

On 13th April, 1931 he was appointed as Upper Grade Assistant on Rs. 200 p.m. (the designation was later changed to Assistant Wood Seasoning Officer) in the Wood Seasoning Section of the Forest Economics Branch (Later changed to Utilization Branch) of the Forest Research Institute, Dehra Dun.

He served the Institute in various capacities till he retired after three years’ extension of service on the 10th of September 1972. While recommending extension of his services to the Government of India, Shri R. N. Datta, the then President wrote, *“During all these years he has been engaged in research problems relating to forest products and the knowledge and experience gained by him will be of great value to the country. He is an expert of high reputation in this field of work and possesses a wide knowledge of allied fields and assists workers in other branches, with suggestions from his wide experience. He maintains contacts with industries and outside workers and is well thought of in international circles. He is undoubtedly a technical officer of the widest experience on the research side in the Forest Research Institute at present.”* The successive posts held by Dr. Narayanamurti at the Forest Research

Institute were—April 13, 1931 to March 31, 1940, Assistant Wood Seasoning Officer with additional charge of Wood Preservation Section from May 3, 1938; from April 1, 1940 to May 20, 1947 he was wholly working as Officer-in-charge, Wood Preservation Section; from May 20, 1947 to May 2, 1950 he was Chief Research Officer, Composite Wood and Wood Preservation Branch; from May 3, 1950 to September 10, 1962, he continued as Chief Research Officer, Composite Wood Branch.

In addition to the above posts he held from December 10, 1956, the post of Personal Assistant to the President which involved coordination of technical work of the Institute and attending to the enquiries of a technical nature. The designation of the post was changed to Assistant President on September 29, 1959. From November 1, 1957 as a result of reorganisation in the Forest Research Institute, he became Head, Division of Mechanical Technology for Coordinating the work of the Timber Mechanics, Timber Engineering and Composite Wood Branches. From June 1960 to January 1961, he functioned as President of the Institute.

He was appointed by the Government of India as Professor Emeritus at the Forest Research Institute and Colleges, Dehra Dun with effect from February 19, 1966 and he functioned in that capacity till February 18, 1972.

After his retirement from Government service in 1962, Dr. Narayanamurti was appointed as the first Director of the Indian Plywood Industry Research Association, Bangalore, subsequently designated as Indian Plywood Industry Research Institute. He worked there from September 11, 1962 to September 10, 1969 when he attained the age of 65. During this period he planned, established, equipped and staffed this new Institute, which would ever remain a monument to his abilities.

Even at his advanced age, Dr. Narayanamurti refused to live a retired life. He took on an assignment as an emeritus Scientist of the Council of Scientific and Industrial Research and worked at the National Aeronautical Laboratory, Bangalore. Later, he was Principal Investigator of a U.S. financed PL-480 project at the Department of Aeronautics, Indian Institute of Science, Bangalore. At the time of his death he was giving the finishing touches to the final report on this project.

CONTRIBUTIONS TO SCIENCE

While his earlier contributions were in the field of biochemistry, the major part of his subsequent career was devoted to wood science with particular emphasis on composite wood and adhesives. He made different types of adhesives for the plywood industry from several indigenous protein materials and also developed synthetic resins suitable for Indian woods. He developed different forms of plywoods, hard-boards, particle-boards for Indian Industry and special types of improved woods needed for defence, aircraft and railways. He developed techniques of evaluation of basic properties of composite materials and collected considerable amount of data on Indian species. Among his fundamental investigations, were swelling pressures and shrinkage of wood and wood products, permeability and diffusion characteristics, rheology of wood and adhesives, influence of wood extractives on utility characteristics such as durability, glueing, etc. His scientific papers covered almost all aspects of wood science and his admirers in scientific field considered him as a pioneer in the field of wood science in India.

FAMILY LIFE

Dr. Narayanamurti married Janaki, daughter of S. Subramania Iyer of the Postal Service on 28th June, 1920. The couple lived to celebrate their golden wedding anniversary in 1970. It was a very happy and fruitful marriage. There were six children Ramdas (1927), Visalakshi (1928), Ramanarayan (1931), Duraiswamy (1936), Venkatesh (1939), and Shankarnarayan (1947). All are well settled, and one of them, Venkatesh is a Scientist working in the U.S.A. The daughter married a Scientist, Dr. S. R. D. Guha who at present is In Charge of Cellulose and Paper Branch in the Forest Research Institute. Dr. Narayanamurti was a stern but an appreciative husband and a father. He was a deeply religious man.

ASSOCIATION WITH SCIENTIFIC BODIES

Dr. Narayanamurti was associated with the following professional bodies :

1. Full Member, Verein Deutsche Ingenieure, Berlin.
2. Fellow of the Physical Society, London.
3. Member of the Faraday Society, London.
4. Member of the Kolloid Gessellschaft, Leipzig.
5. Member of the Biochemical Society, London.
6. Member of Society of Biological Chemists (India).
7. Fellow of the Royal Institute of Chemistry, London.
8. Fellow of the Institute of Physics, London.
9. Member of the Institute of Chemical Engineers, London.
10. Fellow of the International Academy of Wood Science, Vienna.
11. Fellow and formerly President of the Indian Academy of Wood Science, Bangalore, India.
12. Fellow of the Indian National Science, Academy, New Delhi.
13. Member of the F.A.O. Working Group on Wood Chemistry.
14. Member of the International Committee on Rheology.
15. Member of the Commonwealth Composite Wood Corresponding Committee.
16. Chairman of the I.S.I. Sectional Committee, BDC : 20 on Wood Products and on Sports Goods and he was also a member of several of the I.S.I. Sub-Committees.
17. Member of the Council of the Aeronautical Society of India.

DISTINCTIONS

In 1944, Dr. Narayanamurti was decorated with the Order of the Member of the British Empire (M.B.E.) for scientific work done for the Defence Services. The citation reads "*As a Scientist you have rendered good service to India. You have been responsible for inventions which have already been adopted by the Defence Forces and which will be of great value after the War. Your most striking achievement has been the making of compregnated wood from Indian timbers of a quality as good as or superior to European productions.*"

For his meritorious services as a Scientist, for over 25 years, Dr. Narayanamurti was awarded on the 8th December 1956 a "Jubilee Medal" on the occasion of the Golden Jubilee Celebrations of the Forest Research Institute, Dehra Dun.

M. B. RAIZADA

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A. Latini

ADINATH LAHIRI

(1916-1975)

Elected F.N.I. 1960

ADINATH LAHIRI was born on August 24, 1916 at Pabna (now in Bangladesh). His father, Anadinath Lahiri was Special Magistrate (1st Class) there. His mother Smt. Suprava Lahiri is living in Hazaribagh.

Adinath Lahiri received his education in the University of Calcutta. He obtained his B.Sc. (Hons.) in Geology in 1936 and M.Sc. (Geology and Geochemistry) in 1938, from the University of Calcutta.

In 1938, Lahiri went to London University for his doctorate on a '*Sir T. N. Palit Foreign Scholarship*' of the Calcutta University. He was awarded the Ph.D. degree in 1941 and also the '*Judd Memorial Prize*' of Imperial College of Science and Technology for the best thesis in Geochemistry. He also secured the Diploma of Imperial College in 1942.

PROFESSIONAL CAREER

He began his professional career as a Research Associate in the Imperial College of Science and Technology in 1942 and was Scientific Officer, and later Head, of the Fuel and Oil Research Section of the Royal Aircraft establishment, Farnborough, U.K., during the Second World War. At the invitation of the late Dr. S. S. Bhatnagar, Dr. Lahiri joined the Council of Scientific and Industrial Research (CSIR) as Assistant Director (Planning), Central Fuel Research Institute (CFRI) in 1945. In 1946, he married Kohinoor of the Natore Raj family. They have two sons. The elder, Dr. Abhijit Lahiri, is doing M.R.C.P. in London; the second son Shri Ranjit Lahiri is studying Mechanical Engineering at the Birla Institute of Technology, Mesra, Ranchi.

Dr. Adinath Lahiri became the Deputy Director of the Central Fuel Research Institute in April, 1953 and Director in April 1954, from which post he retired in 1974. After retirement he took up the assignment as UNDP Adviser to the Republic of Chile, South America. He breathed his last due to Cardiac failure on 26th August, 1975 in London on his way back to India after completing a year's UNDP assignment.

CONTRIBUTIONS TO COAL TECHNOLOGY

Following the first Director of CFRI, Dr. J. W. Whitekar, Dr. Lahiri organised, counselled and guided the Research and Development activities on fuels in India

in a systematic manner. The Institute in its early days included liquid fuels as a field of study. Subsequently, when the plan for setting up an exclusive institute for liquid fuels was given final shape and the Indian Institute of Petroleum was set up at Dehra Dun in 1959, the CFRI under the guidance of Dr. Lahiri concentrated its attention on coal science and technology. Similarly, plans for the establishment of a Central Mining Research Station to deal with the mining problems of coals and other minerals were also formulated by Dr. Lahiri at CFRI. Since its inception, the Institute initiated systematic physical and chemical quality assessment of the working seams and cores of the bore holes drilled by the various exploration and coal producing organisations, through seven field laboratories established in the various coal fields of the country. These data have been useful in planning the development and utilisation of the national coal resources. The survey helped in the identification of over 1300 million tonnes of new resources of coking and blendable coals. The survey also indicated that beneficiation of coking coal is essential for efficient utilisation. Dr. Lahiri and his group carried out intensive researches on this aspect and the results of these studies have been utilised in setting up 9 public sector coal washeries, with installed capacity of 30 million tonnes annually. The studies of Dr. Lahiri and his collaborators have led to many improvements in washing technology, some of which have been internationally adopted.

Dr. Lahiri and his group at the CFRI carried out valuable work on the preparation of coal for charging into coke ovens, and blending of coals of different coking potential, so that maximum conservation of the prime coking coal is possible. The investigation was carried out from four angles : (i) judicious use of prime coking coal, (ii) up-grading of inferior coal, (iii) using sub-standard coking coals in blends with superior grade coking coals and (iv) adopting improved iron and steel melting techniques. Indeed, the coal blends used in public sector steel plants and merchant ovens often using up to 50 per cent non-stand plants, are those selected on the basis of laboratory and pilot scale experiments carried out at CFRI. Dr. Lahiri and his group devoted considerable attention since 1964 to the development of technology of using non-coking coals for the production of blast furnace fuel. On the basis of these researches, the first commercial-cum-demonstration coke plant of 350 tonnes daily capacity has been recently set up. If successful, this will go a long way in expanding iron and steel industry since non-coking coal is available in about eight States and iron ores occur practically all over the country.

Dr. Lahiri and his colleagues at CFRI developed a new Beehive Coke Oven design which nearly trebled the productivity of the existing ovens with consequent economic advantage and lowering the cost of production.

The CFRI under the leadership of Dr. Lahiri has made significant contributions to the development of technology for processed fuel for home and industry. Methods for converting low grade coals, both coking and non-coking, which are abundantly available, into processed solid fuel, were developed. A simple moving devolatilizer, without recovery of byproducts to produce domestic fuel is already commercialised. Similarly, two processes which employ coke breeze, coal fines, slack coal, etc., and plants of 100 tonnes/day capacity for producing acceptable quality of domestic fuel are being established.

A narrow brick vertical retort has been developed for large scale production, for low temperature carbonisation technique, wherein external heating of the coal with or without internal recirculation of gaseous products to increase productivity of the ovens is adopted. A plant of this model of 1500 tonnes daily capacity, using coals of the Raniganj area is being set up near Calcutta to provide solid and gaseous fuels to the Calcutta Metropolitan area.

Dr. Lahiri also carried out valuable work on the isolation and recovery of useful chemicals from the by-product coal tar and gases both from high temperature carbonisation and low temperature carbonisation of coals. Processes have been developed for production of useful products like resins, phthalic anhydride, anthraquinone, maleic anhydride, xylenes, cyanopyridines, nicotinic acid, isonicotinic acid, benzaldehyde, benzoic acid, benzonitrile, phthalonitrile, cresols, naphthol, resorcinol, etc. Active carbon and ion exchangers for determination of water-based coal were developed. Some of these processes have found industrial application in the country.

Dr. Lahiri guided another group at CFRI for the development of technologies for conversion of coal to gas and liquid fuels. Major pilot plants such as high pressure fixed bed gasification unit of capacity 800 kg/hr and a Koppers-Totzek plant of 6000 cu. ft. of gas out/hr have been set up at the CFRI campus and several varieties of non-coking Indian bituminous coals have been evaluated in these plants. Investigations were also carried out for the direct hydrogenation of coal for synthetic liquid fuels and it was found that North Assam Majum coals could be converted to liquid fuel to high 95%. These studies have led to the formulation of a major feasibility report for establishing a coal to oil plant of 66,000 barrels capacity per day.

Under the leadership of Dr. Lahiri, the CFRI has established facility for high pressure vapour phase catalytic hydrogenation unit (100 gals/day) for production of synthetic fuels from tar.

Amongst other important contributions of Dr. Lahiri and his group at CFRI is the effective use of coal even up to 50% inerts in the thermal power stations. Since about 50% of the coals fed to the washeries resulted in high ash by-products, the use of such low grade coal at the thermal power stations has made coal beneficiation in the country economic.

Dr. Lahiri has guided fundamental researches on the techniques of hydrogenation, pyrolysis, etc., which have led to basic knowledge on the state of combination of carbon and hydrogen in the coal molecule. Dr. Lahiri has also made valuable contributions in petrography, mechanism of oxidation, solvent extraction, surface chemistry of coal and catalysts and adsorbents.

Reputed internationally as a fuel scientist and an authority on coal, Dr. Lahiri was greatly responsible for making the CFRI a premier institute in the world for research in fuel science and technology.

Dr. Lahiri had a deep passion for conceptual planning for the development of projects of integrated coal-based industrial complexes. In industrial planning, the Durgapur Industrial complex in West Bengal is an example of his conception. Earlier in 1954 and later in 1965 on the Energy Survey Committee and subsequently in 1974 in the National Fuel Policy Committee, he took a leading part in formulating the National Fuel Policy of the country.

HOBBIES

Dr. Lahiri kept himself intimately in touch with nature. He was deeply interested in the habits and behaviour of the panther and leopard. Although he shot a few wild animals in his early days, later he never shot any animal but found much delight in photographing animals in the forest under natural conditions.

Dr. Lahiri was fond of gardening and agriculture. In his residence at Hazaribagh (Balaka) he grew many varieties of roses and orchids collected from different parts of the world.

Children's education was uppermost in the mind of Dr. Lahiri. The present Mount Carmel School for girls and boys at Digwadi had its origin due to the untiring efforts and interest of Dr. Lahiri. Similarly, Dr. Lahiri was interested in the welfare of his workers in the Institute and spared no pains in helping them.

HONOURS

Dr. Lahiri was associated with a large number of technical committees and visited various countries as a member or leader of technical delegations. He was a fellow of a number of academic and professional institutions in India and outside including the Indian National Science Academy, Institute of Engineers, Institute of Fuels (London), etc. He was awarded Padmashri in 1960 and Padmabhushan in 1969. For several years, he was a Director of the National Coal Development Corporation. He had to his credit about 90 patents. During his active scientific career (1947-1973), he published 591 papers and reports along with his collaborators (list attached).

The monumental contributions of Dr. Lahiri to Coal Science and Technology at the CFRI, Dhanbad, Bihar will be well remembered by the entire future generation involved in solving the energy problems of the Globe.

SATYAPRASAD RAYCHAUDHURI

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B. Sen

BIBHUTIBHUSAN SEN

(1898-1976)

Elected F.N.I. 1952

EARLY LIFE

PROFESSOR BIBHUTIBHUSAN SEN was born on 1st March, 1898 in village 'Nayapara' in the district of Chittagong now situated in Bangladesh. His father Shyama Charan Sen was a Government Pleader at Rajan and Dasmanta Kumari Sen was his mother. Sen had a bright academic career. In the year 1913, he passed the Matriculation Examination of the University of Calcutta in the First Division and obtained a Government scholarship standing first among all the candidates from the district of Chittagong. In 1915, Prof. Sen passed the Intermediate Examination in Science of the University of Calcutta in the First Division as a student of the Presidency College, Calcutta and was awarded a general Government scholarship. In 1917, he passed the B.Sc. Honours Examination of the University of Calcutta in Mathematics and got the First position in the First Class. Sen was then admitted to the Post-Graduate Class of the University of Calcutta in 'Mixed Mathematics' now known as 'Applied Mathematics'. However, he did not appear at the M. Sc. Examination as he was deputed by the Government of India for higher training in U. K. for I.F.S. (Imperial Forest Service, later known as Indian Forest Service) as he topped the list of successful candidates in the I.F.S. Examination of the year. On the eve of his voyage to England, he was brought back from Bombay by his father who would not allow his son to be away from him. In 1921, Sen sat for the M. Sc. Examination of Calcutta University in 'Mixed Mathematics' and stood First in recognition of which he was awarded the University Gold Medal.

PROFESSIONAL CAREER

After passing the M.Sc. Examination, Sen served as Instructor in the Ichapore Gun and Shell Factory, West Bengal, for a short period. Sen had an inherent bent for teaching and research in Mathematics, and so he could no longer work in the Factory. Soon he joined the Bagerhat College in the district of Khulna (now in Bangladesh) as a Mathematics teacher. He left this and joined the Ramjash College in Agra and spent a year there. In the beginning of 1924, Sir Ashutosh Mookherjee invited Sen to join the University of Calcutta as a whole-time lecturer in Mathematics, but the sudden death of Sir Ashutosh at Patna put an end to this. In the same year, Sen joined the Educational Service of the Government of Bengal. He taught Mathematics in several Government Colleges.

In 1953, Prof. Sen retired from Government Service. Next year he joined the Birla College of Engineering in Pilani, Rajasthan, as Research Professor and was there till 1956 when he went as Professor and Head of the Department of Mathematics in the Jadavpore University, West Bengal, at the invitation of Dr. Triguna Sen, Rector (later Vice-Chancellor) of the University. Prof. Sen was also Dean of the Faculty of Science and served in that capacity till his retirement in 1963. In the same year, he joined the Visva Bharathi University (Shantiniketan) as Principal of the 'Vidya Bhavan' (College of Post Graduate Studies) as well as Professor and Head of the Department of Mathematics. By dint of his hard work and organising capacity, Prof. Sen developed this institution, associated with the name of Rabindra Nath Tagore and put the Mathematics Department on solid foundations. M.Sc. Classes were opened in the Sciences and Research facilities provided in the University. A number of research scholarships were made available to deserving candidates for carrying on research work and for preparing themselves for doctorate degrees in the Sciences. Towards the end of his life, Prof. Sen was again associated with the Jadavpur University. As a token of respect and honour, the University appointed him Emeritus Professor which he occupied till the 13th December, 1976, the last day of his life.

RESEARCH ACTIVITIES

Sen developed research interest in Mathematics even as a student of the Post-Graduate Class. He was fortunate, as he himself admitted, to have become a student of Prof. S. N. Bose in the class of 'Mathematical Elasticity', his subject of specialisation. In Government Educational Service, it was not easy for Prof. Sen to carry on research work in Mathematical Elasticity, but Sen persevered as he was a part-time Teacher in the Dept. of Applied Mathematics, University of Calcutta, where he taught mainly Mathematical Theory of Elasticity. He prepared more than fifty research papers which were published in reputed journals of India and abroad, including '*Proceedings of the Royal Society of London*', '*Philosophical Magazine*', '*Zeitschrift für Angewandte Mathematik und Physik (ZAMP)*', '*Zeitschrift für Angewandte Mathematik und Mechanik (ZAMM)*', '*Quarterly of Applied Mathematics*', '*Proceedings of the National Institute of Sciences of India*' and '*Bulletin of the Calcutta Mathematical Society*'. A list of some of his published research papers is given in the Bibliography.

ADDITIONAL FEATURES

Prof. Sen was an excellent teacher and his method of teaching impressed students of all classes. An undergraduate first year student could find as much interest in his class as a post-graduate final year student could. With his usual humour, he brought many difficult topics of Mathematics within the reach of his students. He enjoyed teaching, especially the junior classes. His knowledge of mathematics was wide and he was able to teach several branches of the subject.

In 1952, Prof. Sen was elected Fellow of the National Institute of Sciences of India. In the same year, he was President of Mathematics Section of the Indian Science Congress.

One of Prof. Sen's achievements is the formation of a school of research in different branches of Elasticity. Prof. Sen was one of the most successful research guides. About fifty persons obtained doctorate degrees working under him in different branches, such as Elastodynamics, Thermo-elasticity, Visco-elasticity, Piezo-electricity, Magneto-elasticity, Plasticity, Theoretical Seismology, Couple Stresses etc., and also Fluid Mechanics. Many of his students hold high positions in academic fields, in India and abroad.

Prof. Sen was also the author of some notable books on Higher Mathematics. His monographs on '*Special functions*' and '*Laplace Transform*' were published in his life time, but his monograph on '*Numerical Analysis*' was a posthumous publication.

ACKNOWLEDGEMENTS

The author expresses his thanks to Shri Pritibhusan Sen (Younger brother of Prof. Sen), Sri Nirendra Nath Kanungo (a near relative of Prof. Sen), Smt. Parul Pratima Sen (wife of Prof. Sen), Sri Gopendra Narayan Sen and Sri Nripendra Narayan Sen (the two sons of Prof. Sen), and also Prof. M. Mitra (Research student of Prof. Sen) for their kind help in the preparation of this memoir.

A. K. MITRA

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NEDUMANGATTU KESAVA PANIKKAR

(1913-1977)

Elected F.N.I. 1952

THE name and scientific achievements of Nedumangattu Kesava Panikkar will remain fresh in the minds of his many colleagues, friends and contemporaries in India and abroad, because Dr. Panikkar was a man of many qualities; he was not only an eminent scientist but also an outstanding administrator and a public servant. His passing away on 24th of June, 1977, at Trivandrum due to cardiac arrest is a great loss to India and to the scientific community the world over. His contributions to ocean science policy won international recognition for India and have enhanced our country's image and prestige in international circles.

EARLY LIFE, EDUCATION AND INITIAL CAREER

Dr. Panikkar was born on May 17, 1913 at Kottayam in Kerala, in Nedumangattu House, situated on the western side of the famous Thirunakkara Mahadeva Temple. He was the only son of his parents — Shri Sankunni Menon and Shrimati Janaki Amma. Shri Sankunni Menon, who was Headmaster of a Government High School in the Old Travancore State, hailed from Parappanangadi near Kozhikkode, and was a scion of the Royal Family of Mavelikkara.

Dr. Panikkar had his primary, secondary and initial college education in the C. M. S. College, Kottayam. Early in 1930, he joined B. A. (Honours) Class in Zoology in the Madras Christian College, Tambaram. As a student, he displayed keen interest in science and in areas of knowledge not covered in regular class lectures. Field trips and scientific excursions attracted him most. His interests were wide and he was influenced by one of the well-known Professors of that time, Professor C. Lakshminarayanan of the Madras Christian College. He took his B. A. (Honours) Degree in Zoology in the year 1933 from the Madras Christian College, securing First Division and First Rank. Besides being an outstanding student, he was fond of making direct observations on living organisms in their natural habitat. He firmly believed in the Louis Agassiz dictum '*Study Nature and not Books alone*'. It was during one of his favourite field trips undertaken as part of the college curriculum that Panikkar developed an absorbing interest in the study of physiological adaptation of aquatic organisms to rapidly changing brackish water environment. He actively pursued this problem during his research career, initiated and fostered by the late Professor R. Gopala Aiyar, who was Dr. Panikkar's highly respected scientific mentor. Professor Aiyar was Director of the Madras University Zoological Laboratories and subsequently a founder Professor of the Zoology Department of



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Andhra University, Waltair. Dr. Panikkar was awarded the M. A. Degree in 1935 and M. Sc. Degree by research in 1935 by the University of Madras.

His work on the breeding of brackish water animals of the Adyar Estuary in mid-thirties was a new approach to the problem of environmental adaptation. His thesis on this subject submitted in 1938 for the Degree of Doctor of Science, University of Madras, gained for him the unique distinction of being the youngest research worker (at the age of 25) to be awarded the D.Sc. degree by Research.

In recognition of his brilliant academic record, Dr. Panikkar was awarded in 1938 the prestigious *Post-doctoral Fellowship of the Royal Commission for the Exhibition of 1851*. He worked at the Universities of London and Cambridge and also at the Marine Biological Laboratory, Plymouth, from 1938 to 1943. During his stay in the United Kingdom, he came under the influence of some eminent biologists of that time like Professor E. J. Allen, Dr. W. R. G. Atkins, Professor A. V. Hill and Dr. A. Krogh. His work on osmotic regulation of crustaceans, done in Plymouth is a brilliant example of his early scientific research.

In 1943, Dr. Panikkar was invited to head the Department of Zoology of the University College, Trivandrum. He held this position for about two academic sessions but left for Madras to succeed his teacher, Professor R. Gopala Aiyar, as Director, Zoological Laboratory at the University of Madras in 1944. Within a short period of two years, he developed the Laboratory as an active Centre of research before he was called upon in 1946 to take charge as Officer on Special Duty at the Ministry of Food and Agriculture, New Delhi, for organizing fisheries research in India. He helped in drawing up a memorandum to the Government of India on the research and development plan in fisheries for our country. His efforts greatly contributed to the establishment of two Central Research Institutes, namely, the Central Marine Fisheries Research Institute in Madras and the Central Inland Fisheries Research Institute in Calcutta. In 1951, Dr. Panikkar became the Director of Central Marine Fisheries Research Institute, which by then had moved from Madras to Mandapam Camp in Ramnad District.

In 1957, the services of Dr. Panikkar were requisitioned by the Government of India, as Fisheries Development Adviser. In this capacity, he was responsible for the establishment of several separate organizations to deal with research and training aspects in fisheries. Due to his efforts, three Institutions, namely, the Central Institute of Fisheries Technology at Cochin, the Central Institute of Fisheries Education in Bombay and the Central Institute of Fisheries Operatives at Cochin came into existence. These Institutes have grown and each has its own campus and is under a separate Director. Panikkar also organized the fisheries extension service in the Ministry of Food and Agriculture and expanded the Deep Sea Fishing Programme. This resulted in the birth of another institution — the Deep Sea Fishing Station at Bombay. It now has a fleet of research vessels under a separate Director and has been named as Exploratory Fishery Project. He also negotiated the planning of the Indo-Norwegian Fisheries Project in Kerala.

Gradually, Dr. Panikkar's interest in Marine Sciences widened and in 1962, he took charge as Director, Indian Programme of the International Indian Ocean Expedition (IIOE). The programme was at first handled jointly by the Ministry of Food and

Agriculture, the Ministry of Education and the Council of Scientific & Industrial Research and later on came under the umbrella of the CSIR with the Indian National Committee on Oceanic Research (INCOR) as its advisory body. He formulated the Indian participation of IIOE by mobilising different organizations and made use of the Vessel of the Indian Navy, I.N.S. KISTNA, which made 22 cruises in the Indian Ocean and obtained a large volume of data. He organized the Indian Ocean Biological Centre—jointly set up by CSIR and UNESCO at Cochin, for sorting zooplankton collections made by 25 ships during the Expedition. The work on zooplankton resulted in the compilation of a series of Zooplankton Atlases edited by Dr. Panikkar. Under his leadership, India made significant contributions to the study of the Indian Ocean.

The successful completion of IIOE in 1965 formed the nucleus of ocean research in India and the birth of a new Institution — the National Institute of Oceanography (NIO) under CSIR in 1966. Dr. Panikkar was appointed Director of this Institute, a post which he held till he retired in May 1973 at the age of 60. Thus in oceanography, Dr. Panikkar had his longest experience lasting more than ten years.

NIO is the premier oceanographic Institution in India with several disciplines of oceanography carrying out the scientific projects outlined in the draft plan of the Institute.

As a result of Dr. Panikkar's untiring efforts, NIO was able to acquire its first ocean-going research ship, R. V. GAVESHANI, which was commissioned in 1976 for scientific cruises. GAVESHANI will thus remain a 'floating' example of Dr. Panikkar's efforts in this direction. The vessel is now an invaluable tool for scientific exploration of the seas around India, for living and non-living resources, not only for NIO but for several other organizations which collaborate with NIO in marine research.

After a productive period of service, Dr. Panikkar retired at the age of 60 in May 1973. The same day he was appointed a full-time Member of the National Commission on Agriculture, set up by the Government of India. He thus became the natural choice for making suitable recommendations on various aspects of research, development, education and training in fisheries. The Commission's recommendations to the Government mark a valuable contribution of Dr. Panikkar on fishery resources of the seas around India.

After finishing his term as Member, National Commission on Agriculture in 1974, Dr. Panikkar was appointed Vice-Chancellor of the University of Cochin. He was also appointed Chairman of the Committee on Science and Technology of the Kerala Government and a Member, Kerala State Planning Board. At the Cochin University, he took keen interest in the growth and development of the Department of Marine Sciences. He created special Chairs for Physical Oceanography, Marine Geology, Marine Chemistry and Fisheries Technology.

On June 24, 1977, after attending meetings connected with Science and Technology of the Government of Kerala at Trivandrum, he passed away at about 8.30 p.m. Thus ended the vigorous career of Dr. Panikkar, devoted to the betterment of Indian science.

HONOURS AND DISTINCTIONS

Dr. Panikkar received many honours and awards during his career. He was elected Fellow of the Indian Academy of Sciences in 1943, Fellow of the Zoological Society of India in 1947, Fellow of the Royal Society of Arts, London in 1950, Fellow of the National Academy of Sciences in 1951, Fellow of the National Institute of Sciences of India (now Indian National Science Academy) in 1952 and Fellow of the Indian Geophysical Union in 1964.

He was Chairman of the Indo-Pacific Fisheries Council from 1954 to 1957, Sessional Chairman of the First International Oceanographic Congress held in New York in 1959 and of the Second International Oceanographic Congress in Moscow in 1966. He was Chairman, Inter-Governmental Oceanographic Commission of UNESCO from 1964 to 1966 and Member, Scientific Committee on Oceanic Research of ICSU for several years.

He was awarded the '*Galathea Medal*' of Denmark in 1953, the '*Sir Dorabji Tata Medal*' of the Zoological Society of India for 1961-63 and the '*Chandrakala Hora Medal*' by the Indian National Science Academy in 1971. In 1973, in recognition of his contributions to Marine Science and Fisheries, he was awarded '*Padma Shri*' by the President of India.

Dr. Panikkar led several Indian delegations to international conferences on Fisheries, Oceanography and the law of the Sea. He was Member of the Expert Panels on several United Nations Agencies. Dr. Panikkar was on the editorial boards of many scientific journals and publications. To mention a few, he was Editor of the '*Journal of the Zoological Society of India*', the '*Indian Journal of Fisheries*', the '*Indian Journal of Experimental Biology*' and the '*Indian Journal of Marine Science*'. He was also one of the Editors of '*Marine Biology*', an International Marine Science Journal, published from West Germany and of the '*Bulletin of Marine Sciences*' published from Miami, U.S.A.

On his Sixtieth Birthday in 1973, the Marine Biological Association of India honoured him with a Special Publication, containing 36 scientific papers, written by his friends, colleagues and admirers. The volume of 402 pages was dedicated to Dr. N. K. Panikkar.

PERSONAL QUALITIES

Dr. Panikkar was a kind-hearted, calm and pleasant person. He was generous and highly principled. He had the gift of making friends easily and of being helpful. His relations with his students and junior colleagues were very cordial. He loved them and helped them in all possible ways. He was extremely human and God-fearing. To know him well was to respect and admire him. All those who were associated with him as scientists, colleagues or as students, liked him immensely and regarded him as an example of right official conduct. His method of decision-making was based on the larger interest of scientific research in the country. He nurtured human values and laboured hard towards achieving them. His human qualities contributed a great deal towards his success. He was considerate and magnanimous in spite of being a

strict disciplinarian. He took a personal interest in the welfare of his colleagues. He was, without exception, always even-tempered, gracious and urbane. It is an art to be able not only to *win* the favour of his colleagues and a large section of people, but also to *continue* to enjoy it. Dr. Panikkar had mastered this art.

A perfect gentleman of outstanding ability and integrity, Dr. Panikkar always tried to provide a solution to the major problems instead of wasting time on peripheral issues. He seldom allowed himself to be swept away by minor considerations, if it was not in the interest of a larger cause. He encouraged younger scientists to write and publish contributions in their own names. Progressive thinking of this type created noble traditions of research in marine science; this particular outlook deserves a special mention in the interest of growth of Indian science.

His phenomenal memory enabled him to remember not only faces and names but also the disciplines and fields of specialisation of many scientists, irrespective of their standing. It was amazing how he could remember with precision the references in which certain scientific problems were presented. He was equally at home and could speak with competence not only in his specialized fields of marine biology and fisheries, but on the law of the sea, astronomy, literature, botany, ornithology and Indian music. He gave a number of talks on scientific subjects from the All India Radio.

His hobbies were photography, gardening, bird-watching angling and travelling. He was fond of pets and the author remembers him once bringing by air, securely packed with air-holes, all the way from Waltair to Goa, two tortoises which he kept as pets at home.

He had a very wide circle of friends. By his personal charm he enjoyed an enviable position among public servants.

Dr. Panikkar was a devoted husband and an affectionate father. He was deeply attached to his family. He is survived by his wife, Shrimati Parukutty Amma Panikkar, a son and a daughter.

CONTRIBUTIONS TO INDIAN MARINE SCIENCE

Dr. Panikkar's research interests, in his very colourful scientific career, have been as varied as the position he occupied. This is clearly reflected from his publications which do not fall into the category of any one type of specialisation. His contribution to the development of Indian marine science has been so immense that it seems hard to comprehend how one person could achieve so much in such a short span of time.

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the author's own association with Dr. Panikkar goes back to 1957 and this has been helpful in summarising some of his personal qualities.

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